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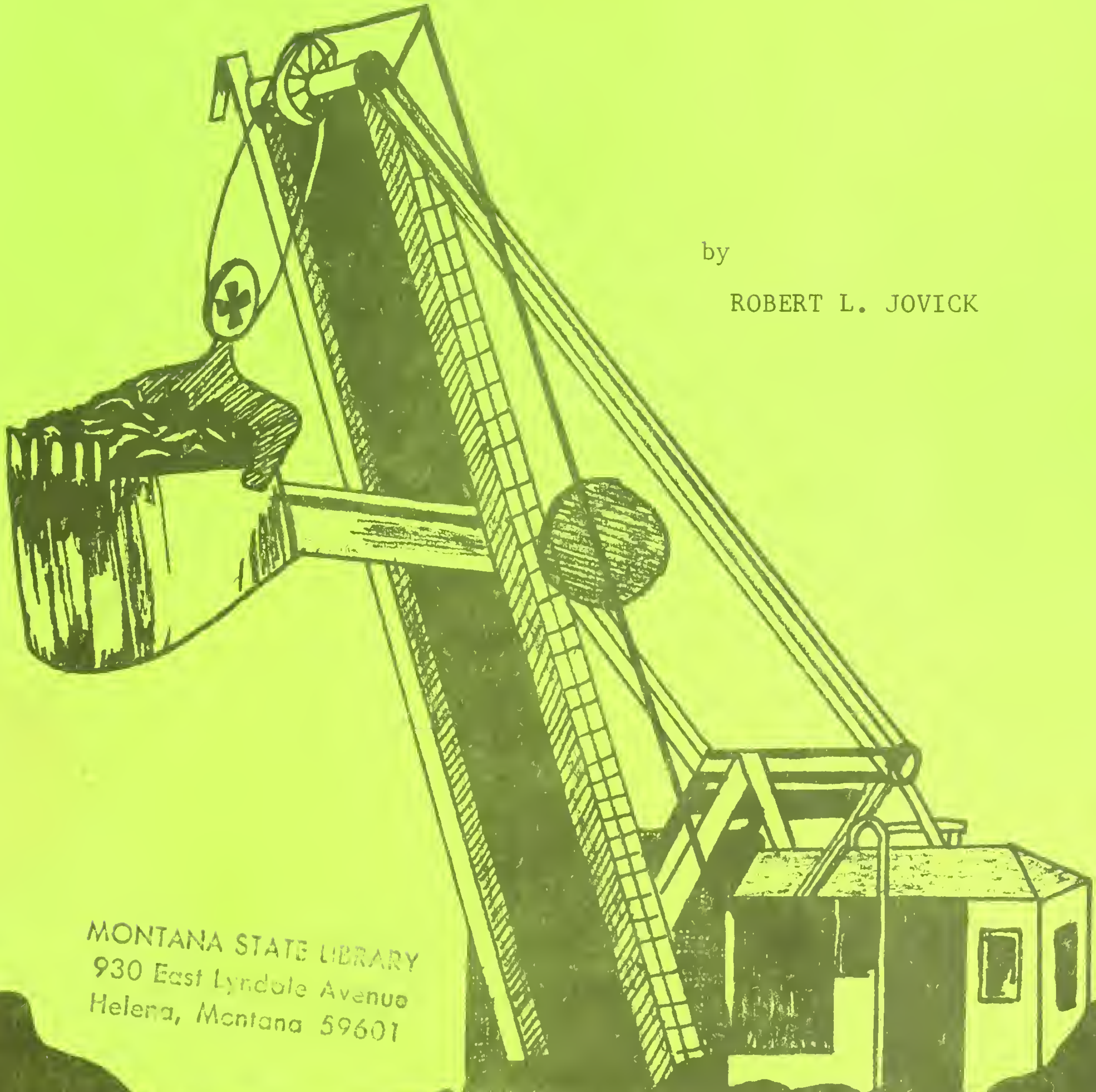

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CRITIQUE OF PROSPECTIVE COAL DEVELOPMENT
IN EASTERN MONTANA

A PROJECT SPONSORED

by

THE ECONOMIC DEVELOPMENT ASSOCIATION

of

EASTERN MONTANA

and

WESTERN INTERSTATE COMMISSION

for

HIGHER EDUCATION

Project Committee
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U. of M.

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CRITIQUE OF PROSPECTIVE COAL DEVELOPMENT

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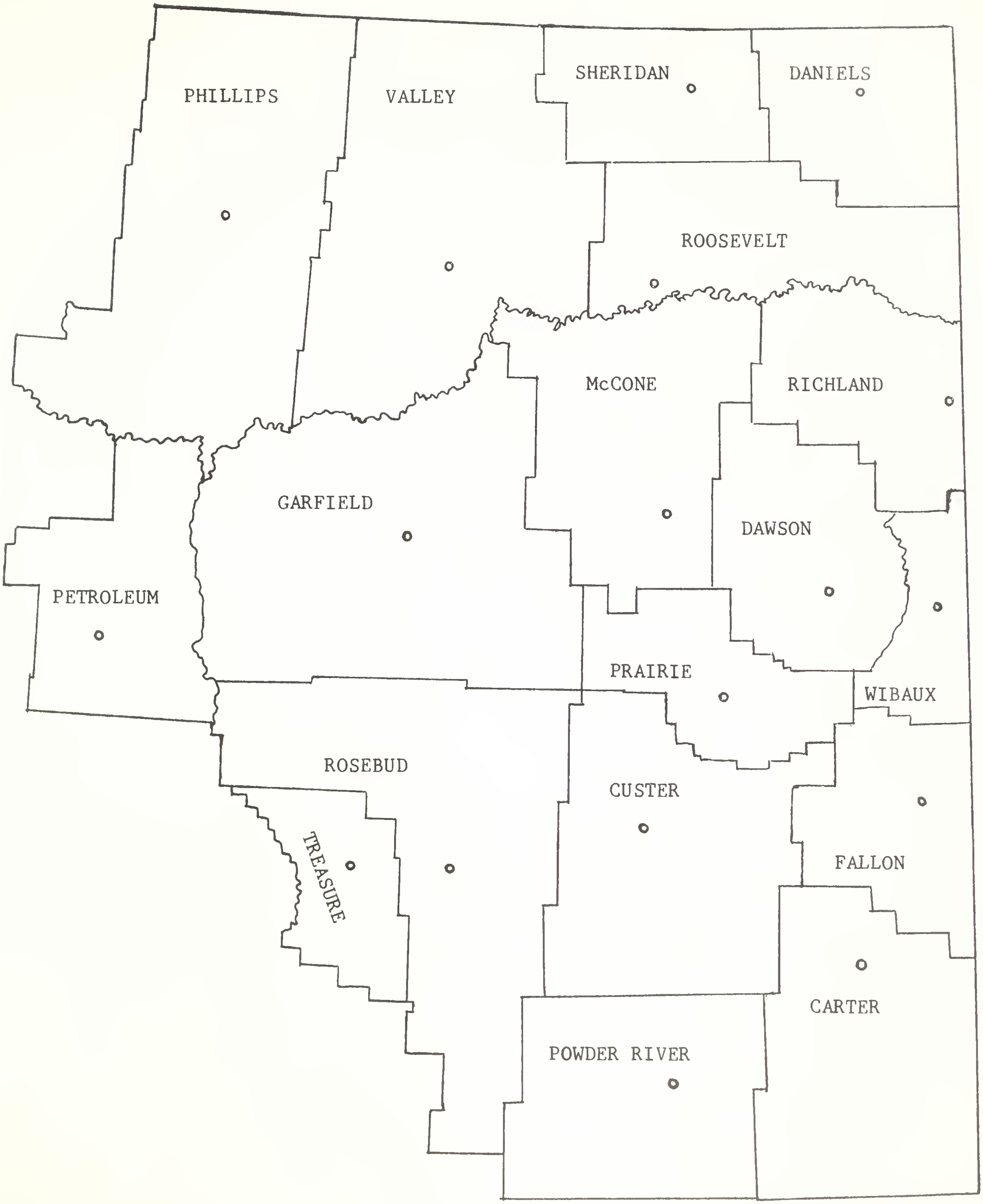

ECONOMIC DEVELOPMENT ASSOCIATION
OF EASTERN MONTANA

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INTRODUCTION

Economic Development Association of Eastern Montana

This study was sponsored and directed by the Economic Development Association of Eastern Montana, (EDAEM). The EDAEM was organized in 1970 to provide regional leadership for the orderly development, improvement, and conservation of the human and economic resources of Eastern Montana. The need for a regional approach to problems in the eighteen county area became particularly apparent when the 1970 census showed a loss of 13,000 people during the sixties.

EDAEM is a voluntary organization of one representative from each of Montana's eastern most counties: Carter, Custer, Daniels, Dawson, Fallon, Garfield, McCone, Petroleum, Phillips, Powder River, Prairie, Richland, Roosevelt, Rosebud, Sheridan, Treasure, Valley, and Wibaux. The delegates must determine the specific goals and priorities of the Association. Projects have included sponsoring area-wide workshops for community leaders, testifying on water development and conservation legislation, securing funds for agricultural research, developing inventories of recreational potentials, and supporting AMTRAK service on the southern route through Montana.

The EDAEM is headquartered in Sidney, where three full-time employees have been assigned to assist the Association. James O. DeBree, Community Development Specialist, and Calvin J. Oraw, Area Community Development Agent, are provided by the Montana Cooperative Extension Service. Donald J. Anderson, Resource Conservationist, is provided by the Soil Conservation Service. The State Department of Planning and Economic Development and the counties provide financial assistance for certain program areas.

NOTE: Numbers appearing in parantheses on the following pages refer to numbered references in the Bibliography at the end of the report.

THE PROBLEM

Almost daily the people of Eastern Montana are reminded that beneath the surface of their land lies a black treasure soon to be unburied. The riches of the vast Fort Union coal region has been rediscovered, but unknown is the future of Eastern Montana as a result of this realization. The timetable and scale of development have been projected and speculated upon. The economic benefits to be reaped have been lauded. The possible environmental costs have been exclaimed. Projections of massive population influxes numbering in the hundreds of thousands have sent even the antelope scurrying for cover. The halls of State and federal agencies have been filled with whispers of impending coal development. The landowner realizes he may own the land, but "Coal is King" and must be mined.

Amidst this disarray of studies, speculation, opinion, and rumor, the Economic Development Association wished to have an assessment of what Eastern Montana could expect as a result of coal development. The economic and social implications of development were desired. What could the cities, counties, landowners, and businessmen expect? Could the area's recreational and service facilities support an influx of people? How many people could be expected? Would the land be restored after mining? When would development occur?

Answers to these basic questions were sought through published studies, visits with State and federal personnel, interviews with coal and utility officials, and discussions with interested people in Eastern Montana. Unfortunately, the study failed to answer the basic and most pressing questions. However, based upon this attempt, possible approaches have been suggested to enable the people of Eastern Montana to not only be informed, but to take a role in whatever development that ensures. These suggested approaches are by no means conclusive, but they appeared to be some of the most viable that emerged from a summer of blind alleys.

It is particularly hoped that this study might serve to clarify the problems rather than to add to speculative endeavors. The energy perspective on a national level was examined as the national energy situation was found to be intimately related to Montana development. Also, solutions to much of the material cited will be helpful to others concerned with the problem.

THE DESERT

> "this country may with propriety be called the Deserts of North America."
> Ordway of Lewis and Clark
> Expedition (83)

Many western Montanans and tourists would be quick to agree with Ordway's description of Eastern Montana. Most East-West highways reveal many miles of rolling prairie and lakeside resorts with majestic mountain views are conspicously absent. But such perspectives reveal that we cannot see the forest for the trees, for there are forests, trees and much more in Eastern Montana.

We have mistakingly classified the biggest portion of the Big Sky Country as a barren land unfit for habitation. Productivity is thought to be confined to cowboys, agates, and an occasional clump of grass. However, a realistic inventory of the land and its resources reveals a contrasting assessment. Only by understanding the present productivity and the future potentialities of the land can we begin to explore the implications of coal resource development.

Of course, forests are not abundant in Eastern Montana, but the Northern Cheyenne ponderosa pine forests in Rosebud County and Custer National Forests in Rosebud, Powder River, and Carter counties provide some wooded, rugged terrain. The Ashland Timber Company in Rosebud County expected to harvest 10 to 11 million board feet of timber. Commercial timber volume on the Northern Cheyenne ponderosa pine forests alone totals about 216 million board feet.(74) Beneath much of this forest lies strippable coal deposits.

Hunting and fishing is excellent in Eastern Montana. Mule and white-tail deer are common, and the largest herds of pronghorn antelope graze in this part of the State. The prairies are the home of millions of upland game birds including sharptailed grouse, sage grouse, ring-necked pheasants, and Hungarian partridge. Fort Peck Reservoir, the Yellowstone River, and the Missouri River, tributaries, and stock ponds provide anglers with a variety of fishing that is difficult to match.

Farm productivity of Montana's 18 Eastern counties is substantial and accounted for 45% of wheat, 23.8% of barley, and 61.4% of oat production in Montana in 1969. Yields per harvested acre for these crops compare favorably with other sectors of the State. This portion of the State was once a major portion of the open range for cattle. The eighteen eastern counties in 1970 accounted for 31% of State cattle production and 50.1% of sheep stock.(9)

The economic rewards for Eastern Montanans reflect the land's productive nature. State per capita income in 1968 was $2,942 while the 18 eastern counties showed a per capita income of $3,103.(9) Resource development to this time has centered on substantial oil and gas resources, but reserves have dwindled in recent years.

Eastern Montana is now waiting to see if its coal resources will be developed with consideration for the land's present and potential agricultural, recreational, and historical values. Or, "King Coal" could rule over the land, air, water, and the people.

THE REVIVAL

Coal mining in Montana first began in the 1980's. Over 4,000 coal miners worked in western and central Montana underground mines in 1918.(27) In 1923, surface mining began at Colstrip, and production peaked in 1944 at nearly 5 million tons.(28) However, the advent of the diesel engine and the use of other sources for heating brought coal mining to a near standstill in the 1950's.

Major population centers still relied upon coal to fuel their steam power generation facilities. Eastern and Mid-West coal was of high BTU value and accessible in substantial quantities. The increasing electrical generating requirements of the cities and a new envrionmental awareness, resulted in steam generation facilities being recognized as major polluters responsible for half the sulfur oxide and for significant portions of nitrogen oxide pollutants. To bring emissions within the government established standards, many companies chose to burn low-sulfur coal available primarily in the western states.

Other companies have chosen to remove particulate matter with expensive (5/Kwe of plant capacity) electrostatic precipitators.(32) Technology for the removal of sulfur dioxides has not been developed to the stage of wide spread operation full-scale power plants. The cheapest system for existing plants would double the solid waste generated per Kwhe and cost $10.00/Kwhe of plant capacity.(32) The estimated effectiveness of removal of SO_2 for suggested processes is 90 to 95 percent, but the highest cost of full-scale testing has inhibited development efforts.

The extent to which the Montana coal revival is due to export, as illustrated in Table 1, with 90% of coal production through the mid-seventies likely to be exported. The sources and consumers of surface mined coal are given in Table 2.

Table 1.

Approximate Coal Production Rates and
Estimates of Future Production*
(millions of tons)

	1969	1970	1971	1972	1974	1977
Western Energy	.52	1.66	5.2	5.2	4.5	10.0
Peabody	.16	1.42	1.5	1.5	3.5	6.0
Knife River	.32	.32	.3	.3	.3	.3
Decker				1.8	5.0	6.0
Westmorland					4.0	6.0
Production Rate	1.0	3.4	7.0	7.6	17.3	28.3
% Export	68	91	94	90	95	88

*Rates based upon company figures and county net proceeds records. Future production based upon estimates of company officials and are likely to vary.

Table 2.

Producers and Consumers of Montana Surface Mined Coal

Producer	Location	Contracts
Western Energy Company*	Colstrip	Commonwealth Edison-Illinois Northern States Power-Minnesota Corrette Steam Generating Plant--Billings Coal Brokers-Minnesota Wisconsin Power-(starting in 1974) Colstrip Power Plants-(starting in 1975)
Peabody Coal	Colstrip	Minnesota Power & Light
Knife River**	Savage	Montana-Dakota Utilities--Lewis & Clark Plant, Sidney Montana

* Wholly owned subsidiary of Montana Power Company

** Wholly owned subsidiary of Montana-Dakota Utilities

based on material obtained from company officials and utility reports.

Coal burning electric generating facilities within the State include Montana-Dakota Utilities, 54,000 KW Lewis & Clark Plant in Sidney that consumes about 320,000 tons of coal per year and Montana Power's 80,000 KW Corrette Plant in Billings that uses about 500,000 tons of coal annually.(52) The Montana Power Company and Pudget Sound Power and Light will build a 750,000 KW mine-mouth plant at Colstrip with the first unit to be completed in 1975. The facility will consume between 2,500,000 and 3,000,000 tons of coal per year and each company will receive one-half of the power.(52)

Numerous estimates of total Montana coal reserves have been made by the U.S. Geological Survey.(8) The most recent efforts at determining the strippable coal fields started in 1965 by the Montana Bureau of Mines and Geology. Through State and federal financing the Bureau has sought accurate data by surface mapping, core drilling, and core analysis. Total strippable reserves have been estimated at over 30 billion tons with average sulfur content less than ½ of one percent.(28) Strippable reserves are those beds that lie close enought to the surface (usually 100 feet) and are of sufficient thickness to be economically mined. Final reports could reveal as much as 50 billion tons of strippable reserves.

The latest report available from the Bureau, on location and fields of strippable reserves is for 23,350 tons of strippable coal. The map of fields is given in Figure 1., and the field descriptions in Table 3. A summary report of the Bureau's work is expected by the Spring of 1973. Some field and county summaries have been prepared by the Bureau of McCone County, Powder

FIGURE 1

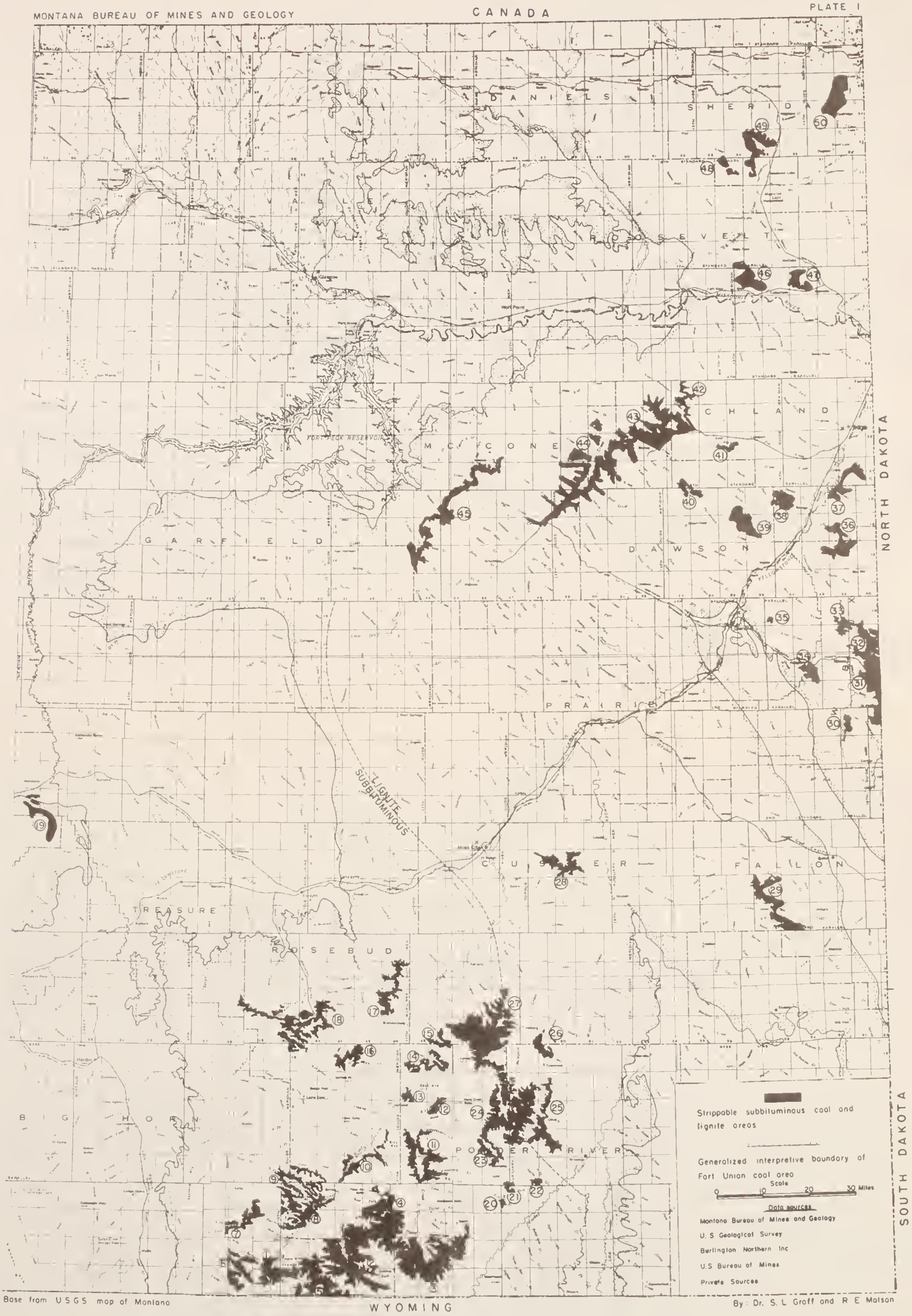

MONTANA BUREAU OF MINES AND GEOLOGY
CANADA
PLATE I
DANIELS
SHERIDAN
VALLEY
ROOSEVELT
RICHLAND
McCONE
FORT PECK RESERVOIR
GARFIELD
DAWSON
NORTH DAKOTA
PRAIRIE
LIGNITE
SUBBITUMINOUS
CUSTER
FALLON
TREASURE
ROSEBUD
BIG HORN
POWDER RIVER
SOUTH DAKOTA
WYOMING
Strippable subbituminous coal and lignite areas
Generalized interpretive boundary of Fort Union coal area
Scale
0 10 20 30 Miles
Data sources
Montana Bureau of Mines and Geology
U. S. Geological Survey
Burlington Northern Inc.
U.S. Bureau of Mines
Private Sources
Base from USGS map of Montana
By: Dr. S. L. Groff and R. E. Matson
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

Table 3.--- Strippable subbituminous and lignite coal fields, eastern Montana

No. on map	Name of field	Coal bed	Thickness in feet	Estimated reserves in millions of tons (R, rough; F, fair; G, good)	Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Btu
1.	Decker	Deitz	20 - 89	1,189 G	21.0	39.0	41.0	4.0	0.4	9,720
2.	Hanging Woman Creek	Deitz	12	1,183 G	24.5	29.8	41.5	4.2	0.2	8,685
		Anderson	20 - 35	1,709 G	25.0	28.0	43.7	3.3	0.2	9,001
3.	Moorhead	Canyon	17 - 25	799 G	23.4	32.3	40.4	3.9	0.2	8,920
		Deitz	6 - 11	357 G	32.4	29.5	34.2	3.8	0.7	8,078
		Anderson	14 - 30	823 G	22.9	32.5	40.4	4.2	0.3	8,790
4.	Pocker Jim Lookout	Anderson & Deitz	58	441 G	32.0	28.5	35.5	4.0	0.2	7,715
5.	Roland	Roland	10	315 F	23.5	34.5	37.2	4.8	1.4	9,009
6.	Squirrel Creek	Roland	10	130 F	30.0	30.5	32.2	7.3	0.7	7,862
7.	Upper Rosebud	Anderson	20	220 F	25.9	31.4	38.2	4.4	0.4	8,528
8.	Birney	Brewster-Arnold	18	202 G	27.3	28.9	39.2	4.6	0.6	8,850
9.	Canyon Creek	Wall	30 - 60	200 F	23.3	31.1	40.1	5.5	0.2	9,030
10.	Poker Jim O'Dell Creek	Knoblock	25	292 G	22.6	29.3	43.4	4.8	0.6	9,136
11.	Otter Creek	Knoblock	20 - 60	1,014 G	26.6	29.6	38.6	5.2	0.2	8,740
12.	Home Creek	Knoblock	55	150 G	27.3	30.5	38.1	4.1	0.1	8,642
13.	Cook Creek	Sawyer	8 - 12	34 G	31.5	29.0	35.5	4.0	0.4	7,965
14.	Beaver Creek	Knoblock	12 - 22	160 F	30.2	27.7	37.0	5.1	0.4	8,401
15.	Liscom Creek	Knoblock	8	75 F	27.6	26.6	32.0	13.8	0.8	7,362
16.	Greenleaf	Knoblock	22	200 F	27.1	28.2	38.5	6.0	0.4	8,692
	Miller Creek	Rosebud	12	60 F	27.1	27.1	39.1	6.7	0.7	8,590
17.	Sweeney-Snyder	Terret	18	250 F	24.6	27.8	38.4	9.1	1.1	8,200
18.	Colstrip	Rosebud	25	1,440 G	23.4	28.6	40.1	7.9	0.7	9,050
19.	Bull Mountain	Carpenter Creek		50 F						
20.	Fire Creek	Pawnee	16 - 20	40 R	33.5	28.3	32.2	6.0	0.4	7,290
21.	Upper Cache Creek	Pawnee	20	40 G	32.0	29.5	32.5	6.0	0.2	7,650
22.	Lower Cache Creek	Broadus	12	10 G	33.5	28.3	32.2	6.0	0.4	7,290
23.	Sonnette	Pawnee	20	206 G	32.0	29.5	32.5	6.0	0.2	7,650
24.	Pumpkin Creek	Sawyer	30	1,900 G	30.5	26.6	37.1	6.3	0.2	7,860
25.	Broadus	Broadus	5 - 26	737 G	28.9	28.9	35.3	6.9	0.2	7,550
26.	Sand Creek	Knoblock	15 - 32	267 G	31.1	27.8	32.8	8.3	0.3	7,220
27.	Foster	Knoblock	8 - 16	1,200 G	31.6	26.8	35.4	6.2	0.2	7,630
		Terret	9							
		Flowers-Goodale	12							
28.	Pine Hills	Dominy E	17	279 G	30.8	27.3	33.7	8.2	0.6	7,220
29.	Lame-Jones		6 - 10	150 R	38.7	27.0	25.1	9.2	0.3	6,020
30.	Lamesteer	Harmon(?)	10	35 R						
31.	Wibaux (Beach, ND)	C	5 - 40	1,204 F	41.0	24.8	26.3	7.9	0.9	6,050
32.	Little Beaver	C	10 - 15	250 R						
33.	Four Buttes	C	5 - 20	91 F	37.9	26.4	26.1	9.6	1.0	6,140
34.	Hodges		7	10 R						
35.	Griffith Creek		10	10 R						
36.	Smith-Dry Creek	G	7 - 15	150 R						
37.	O'Brien-Alkalie Creek		10+	150 R						
38.	Breezy Flat	Pust	9 - 25	200 F	38.7	25.0	29.6	6.7	0.5	6,520
39.	Burns Creek	Pust		200 R						
40.	N.F. Thirteenmile Creek	Pust	10 - 43	225 F	38.3	25.4	30.3	6.0	0.5	6,880
41.	Fox Lake	Pust	7 - 17	46 F	38.3	25.4	30.3	6.0	0.5	6,880
42.	Lane	Lane	7	561 R	36.5	26.9	30.0	6.6	0.9	7,150
43.	Carroll	Carroll	6	345 R	33.0	25.5	36.0	5.5	0.3	7,400
44.	Redwater River	S	9 - 21	642 G	31.7	27.5	35.0	6.1	0.4	7,400
45.	Weldon-Timber Creek	S	8 - 20	724 G	30.5	27.7	35.9	5.9	0.6	7,660
46.	Fort Kipp	Fort Peck	5.3	331 G	42.8	25.7	26.9	4.6	0.2	6,110
		Fort Kipp	8.5							
47.	Lanark	Lanark	7	100 G	38.3	25.4	30.0	6.3	0.4	6,853
48.	Medicine Lake		9	58 F	37.0	26.3	29.5	7.2	1.0	6,870
49.	Reserve		7	246 F	38.5	24.8	29.0	7.6	0.4	6,599
50.	Coal Ridge	Coal Ridge	10	150 F	40.4	24.5	27.6	7.5	0.4	5,830
51.	Sarpy Creek	Rosebud-McKay	10 - 25	1,500 F						
	Total			23,350						

Table 4.

Estimated Original Coal Reserves by County1/

	Original Reserves-millions of tons				% of Total	Strippable*		% of Total
County	Bituminous	Subbituminous	Lignite	Total	Original Reserves	Coal millions of tons	% of Total County Res.	presently known strippable
Big Horn		43,500.65		43,500.65	19.6	6,371.0	14.6	27.3
Carbon	1,247.22			1,247.22	.6	0	--	--
Carter			463.47	463.47	.2	0	--	--
Custer		2,678.86	2,198.85	4,877.71	2.2	1,262.5	25.8	5.4
Daniels			3,964.72	3,964.72	1.8	0	--	--
Dawson			11,110.49	11,110.49	5.0	873.5	7.9	3.7
Fallon			2,544.08	2,544.08	1.1	150.0	5.9	.6
Garfield		612.74		612.74	.3	0	--	--
McCone			24,871.57	24,971.57	11.2	1,045.0	4.2	4.5
Musselshell		3,471.49		3,471.49	1.6	50.0	1.4	.2
Phillips		3.50		3.50	.1	0	--	--
Powder River		40,984.48	2,433.69	43,418.17	19.5	6,645.5	15.3	28.5
Prairie			1,581.27	1,581.27	.7	0	--	--
Richland			21,085.62	21,085.62	9.4	1,237.0	5.9	3.3
Roosevelt			4,164.23	4,164.23	1.9	431.0	10.4	1.9
Rosebud		38,873.78	10.10	38,883.88	17.5	2,816.0	7.2	12.1
Sheridan			5,763.82	5,763.82	2.6	454.0	7.9	1.9
Stillwater	12.67			12.67	.1	0	--	--
Treasure		1,303.66		1,303.66	.6	327.0	25.1	1.4
Valley			257.93	257.93	.1	0	--	--
Wibaux			7,040.73	7,040.73	3.2	1,687.5	24.0	7.2
Yellowstone		590.20		590.20	.3	0	--	--
Totals	1,259.89	132,019.36	87,490.57	220,769.82	99.4	23,350.0	10.6	100.0

* Recoverable Coal - use a 20% reduction factor applied to strippable coal.

1/ These reserves were estimated to lie within 2,000 feet of the surface, however, 75% of the total is within 1,000 feet of the surface.

SOURCE: Eastern Montana Basins Study, Bureau of Reclamation, Great Falls, Montana, 1971.

River County, Foster Creek, and Moorehead.(46,47,48,49) Individual county reserves are provided in Table 4. based upon the 23,235 billion ton figure of strippable reserves.(78)

Leasing activity continues to accelerate. The federal government is the biggest lessors of coal development rights and has 36,152 acres under coal lease and 43,629 under application. Table 5. gives the lessees and applicants for federal lands. Leases to date and under application are primarily in the Colstrip area of Rosebud County, the Decker area of Big Horn County, and the Bloomfield area of Dawson County.

The extensive federal role can be partially assessed by noting ownership of State lands in Table 6. The Bureau of Land Management administers mineral resources on about 38,000,000 acres or one-third of the State area. This figure includes about 12,000,000 acres where the surface is privately owned and the minerals are reserved to the United States, as well as Forest Service administered lands, where patents have been issued with a reservation of minerals.(55) In regions where strippable coal is present, the federal government owns about one-half of the coal rights.(54)

Federal preference right leases maybe issued as a reward for finding coal in areas where the U.S. Geological Survey has no record of coal deposits.(55) A prospecting permit maybe issued for such purposes. Applications for leases are made through the Bureau of Land Management who then has an evaluation of the resources and mining plan made by the U.S. Geological Survey. This evaluation coupled with a BLM review of mining implications for the land and area, leads to a final decision on lease applications. The USGS collects royalties on the 20 year leases which are 5% of the product value and for lignite not less than 15 cents the first ten years and 17.5 cents the second ten years and for subbituminous, not less than 17.5 cents the first ten years and 20 cents the second ten years. The BLM is responsible for reclamation consideration.(12)

Table 5.

Federal Coal Leases and Lease Applications*

Lessee	Acres Leased	Acres Under Application
Carlson, Vic & Jack		80
Concho Petroleum Co.	540.86	
Consolidation Coal Co.		428.6
Decker Coal Co.	13,610.3	
Divide Coal Co.	80	
Hjelm		6,084.8
Johnson, Glen	80	1,440
Knife River Coal Co.	960	
Long & Stewart		3,408.36
Meged, George & Paul		160
Mock, Glenn	40	
Norsworthy & Reger		22,465.5
Pacific Power & Light	3,066.76	2,440

Table 5. continued

Federal Coal Leases and Lease Applications*

Lessee	Acres Leased		Acres Under Application
Peabody Coal Co.	4,306.55		
Reliable Coal Co.			640
Rosebud Coal Sales	1,198.16		
Snodgrass, Don			400
Stanich, G. & Bungi, A.	80		
U.S. Steel Corp.	5,096.18		
Western Energy	12,885.39		6,082.35
TOTAL	36,152.11		43,629.61
		79,781.72	

* as of July 18, 1972

SOURCE: Bureau of Land Management, Billings

Table 6.

Montana Public Land Statistics

Ownership - June 30, 1969

29.6%	Federal Government	27,624,634 Acres
5.5%	State Government	5,121,835 Acres*
1.4%	Railroads	1,290,198 Acres*
63.5%	Private other than Railroads	59,234,373 Acres*

Montana - Federal Ownership by Agency - June 30, 1969

		Acres	Percent
FS	Forest Service	16,669,523	60.4%
BLM	Bureau of Land Management	8,162,571	29.4%
NPS	National Park Service	1,156,513	4.2%
CCE	Corp of Civil Engineers	606,473	2.5%
BSF&W	Bureau of Sports Fisheries and Wildlife	511,910	1.8%
BOR	Bureau of Reclamation	301,350	1.1%
BIA	Bureau of Indian Affairs	126,497	0.5%
ARS	Agricultural Research Service	72,311	0.3%

* corrected to conform with current information received Burlington-Northern Railroad--May, 1972.

SOURCE: Public Land Statistics, 1970.

The State is also leasing and collecting royalties from substantial coal properties. As of January, 1972, the State had 57,537.23 acres under coal lease out of its 5 million acres held in trust for the support of common schools. (64) The State properties are quite scattered, and among the major lessors are Aryshire Coal Co., Decker Coal Co., Consolidation Coal Co., and Peabody Coal Co. State lands are leased by competitive bids for coal rights on properties approved by the State Board of Land Commissioners. Ted Schwinden, Commissioner, Department of State Lands, expects another coal sale about November, 1972. (royalties??)

Private leasing is another piece of the leasing puzzle. Records of private leases are scattered and incomplete. Leases maybe filed in the Clerk and Recorder's Office of each county, but there is no legal requirement for filing. As leasing is extremely competitive, there is little incentive for prompt lease filings. For example, the records of coal rich Rosebud County show less than 15,000 acres under lease with the latest filing discoverable in April, 1970.(36) Leases are filed according to an alphabetized system of lessor and lessee with other mineral leases, including oil and gas properties. Companies may buy the land with mineral rights attached, in which case there is a separate set of alphabetized voluminous volumes. It is apparent that this approach yields minimal information of value.

The most important aspect of private leasing is insurance that the landowner is aware of the implications of all provisions of the leasing agreement. Provisions of some leases imply that complete power of gasification facilities could be built. The effect of mining activity on existing buildings, fences, and farming or ranching operations should be carefully assessed. Reclamation provisions should be included where the landowner leases coal or surface rights.

Royalty provisions on coal currently yield from fifteen to seventeen cents per ton mined. For one acre at fifteen cents per ton on a seam twenty feet thick with 1,600 tons recoverable per acre foot, yields $4,800 per acre in royalties. Some areas where the Decker Coal Company plans to mine have seams 70-80 feet thick.(14) A private landowner would receive about $16,800 per acre royalties on a 70 foot seam using the above criteria. In addition, a set price per acre is paid for destroying land when it is mined, a bonus usually from $1-$10 per acre is paid, and land is rented for about $1.00 per acre. If properly managed, the mining of coal can reap rich rewards for the landowner.

Coal properties on the Crow Indian Reservation and Northern Cheyenne Indian Reservation are extensive. A study of mineral resources on Indian lands was done by the Bureau of Mines in 1970.(76) In 1970, Westmoreland Resources Group purchased $462,500 worth of coal rights from the Crow Indians. The Indians have ownership and control over their lands and coal rights, and lands have been actively explored.(18) The situation with Indian mineral rights is complex since land once part of the reservations, was later homesteaded after sizes of the reservations were reduced. The Indians reserved the mineral rights in most cases, but many homesteaders believed the rights to be theirs under the Homestead Act. The complexities of these conflicting laws and claims will not be settled easily.

This summarizes current inventory and confirmed development activity in the State. To project further we must look at four factors: (1) the likelihood of continued economic attractiveness of western coal for export, (2) possible expansion of existing and announced facilities, (3) the national and regional energy demand, and (4) coal research and economics.(27) The first two areas of export and expansion of existing facilities will be examined and the latter two will be explored in the next chapter.

The attractiveness of western coal for export will continue to be dictated by a corporate economic decision between cost of western coal and cost of pollution abatement equipment. High cost of development research and equipment would be a plus for exportation, and with the passage of time, more utilities must comply with stricter emissions standards. The feasibility of the unit train concept will be enhanced with experience, and the Burlington Northern Railroad will hasten to make the option economically attractive, since it receives royalties from its coal properties and freight for hauling mined coal.(59) Evidence also indicates that the more recent contracts negotiated by the coal companies are 20 year long-termed contracts as opposed to the initial short-term commitments. Assuming that a regional demand will also be present, this consideration indicated a growing export market to Eastern Montana coal.

Possible expansion of existing and announced facilities should not be great. The only known plans for such expansion are those of Montana Power's to build additional units at Colstrip after the initial facility is constructed in 1976. Officials of the company estimate between a 2,000-3,000 MW range can be anticipated.

Exportation and current facilities are minor compared to potential future developments that an examination of the national energy situation reveals.

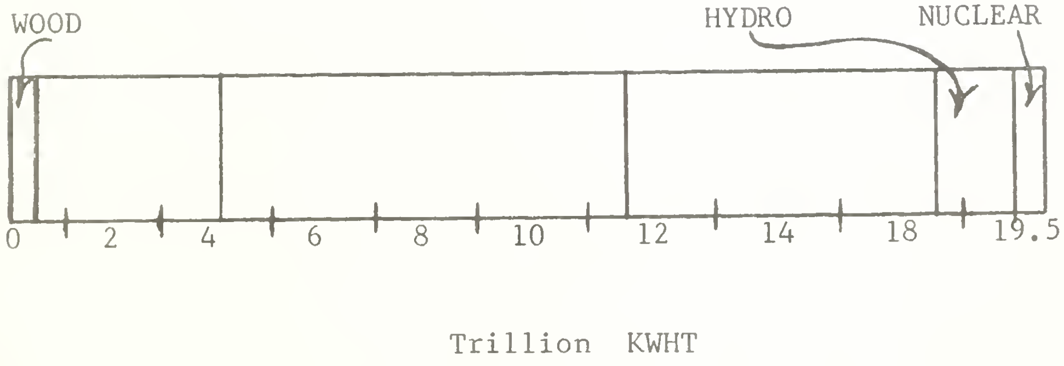
ENERGY DEMAND AND RESEARCH

National energy requirements and research developments maybe examined to assess whether coal will be used to fulfill energy demand. Current forms of U.S. energy consumption are ginen in Figure 2. It can be observed that the nuclear component accounted for less than one-quarter of one percent of demand in 1969. The immediate likelihood is small of nuclear energy satisfying the major share of electrical demand requirements. Table 7. shows that electricity accounts for less than 25% of U.S. energy consumption. Nuclear energy is not used as a source of raw heat for industrial purposes not is it economically feasible as a probable energy source. The Atomic Energy Commission estimates that 1980 will see 150,000 MW installed nuclear capacity or 25% of total electric power.(62) This capacity would account for only a small portion of total energy needs, as electricity consumption accounts for less that 25% of U.S. energy requirements given in Table 7. Nuclear growth has also been inhibited by environmental considerations surrounding nuclear plant siting.

The demand for all energy sources will continue to rise dramatically. Published forecasts based upon growth rates of the early sixties range from 1.4-1.6 times the 1968 consumption in 1980 and 2.5-3.3 times the 1968 figure in year 2000.(33) A growth rate of the late sixties would yield a requirement 4.7 times the 1968 figure in the year 20000. Energy officials have forecasted a doubling of energy consumption between 1970 and 1985. Seven forecasts for 1980 prepared since 1965 range from 1.8-2.2 times the 1968 electricity consumption.(35)

Figure 2.

U.S. Energy Consumption in 1969 (5)



Supplies of energy must expand to meet this growing demand. A recent study by Dr. H.R. Linden of the Institute of Gas technology, summarized the estimated nonrenewable energy resources given in Table 8. Coal comprises over 30% of the total. Although only $.0675.10^{18}$ BTU was used in 1970, a 4% rise in energy requirements would deplete U.S. Reserves in 100 years and in less than 80 years without the breeder reactor.(32) Foreign import of oil and gas is possible and will continue to grow. However, limiting factors to this approach include

Table 7.

U.S. Energy and Electricity Consumption, 1968*

Energy Consumption		Electricity Consumption	
Total Electric Generation	22.5%	Industrial	32%
Non-Electric Household & Commercial	21.8%	Household	21%
		Commercial	43%
Non-Electric Transportation	24.2%	Other	4%
Non-Electric Industrial	31.0%		
Other	.5%		

*SOURCE: Statistical Abstract of the United States, 1970 ed.

Table 8.

U.S. Non-Renewable Energy Reserves

	10^{18}BTU
Natural Gas	1.50
Natural Gas Liquids	0.15
Crude Oil	1.94
Coal	28.66
Shale Oil	11.60
Bitumens	0.01
Uranium Oxide*	48.60
Total	92.60

* at less than $15/short ton. Assumed used in breeder reactor.
SOURCE: Gasification of Western Coals, J. Huebler, Institute of Gas Techonology, Chicago, Illinois, p.l., June, 1972.

security of supply, balance of payments problems, and a depletion of world fuel supply as well. However, import restrictions would probably have to be continued to insure that proper long-range planning and development on gasification and liquid fuels continues.(17)

The U.S. Coal reserves of about three billion tons can be put into more perspective by noting that two-thirds recovery and conversion to gas would yield 20 times the total extimated gas supply. A similar conversion of all coal to oil would produce ten times the proven world's supply.(8) That the coal will be needed for such purposes is provided by a projection that the deficit in 1985 for liquid and gaseous fuels will be 45 quadrillion BTU out of a total of 87 quadrillion requirement. (17) This is about equal to total 1971 production and will have to be filled by either imports or domestically made synthetic fuels.

Three major gas companies have negotiated for ten billion dollars worth of gas from Algeria through 1997, and gas companies maintain current requirements may not even be fulfilled at officially regulated rates.(20) At least 23% of oil requirements are satisfied by imports.(41)

Regional studies provide some insight into prospects for Montana coal production itself. One study by Harold D. Levine, an engineer well acquainted with the field, estimated Montana 1985 coal production at 81 million tons leveling to a constant 1990 figure of 87 million tons.(41) This compares to the 7 million tons produced in 1971. A regional study by the Bureau of Mines of the Powder River Basin area which includes three northern Wyoming counties, projected Basin production in 1990 of 75 million tons with low coal use, 426 million tons with medium coal use, and 763 million tons with high coal use.(75) This contrasts with Levine's projection of 205 million tons production for Montana and Wyoming in 1990.(41) This range of projections between high and low usage varies by over 550%.

The regional picture is thus one of certain massive development, but how massive is massive? The economic implications will be described in a separate section, but a related problem to the energy supply question is the prospective time when development will occur. The timing of the major development relates to the progress of research of fossil fuel conversion and individual company shortages of gas fuel.

Development of coal conversion research has been coordinated by the Office of Coal Research in the Department of the Interior. Since its staffing in 1961, its budget has grown from one million dollars to a fiscal 1973 budget of 45 million dollars.(8) Four processes are currently under development to convert coal to high BTU pipeline gas. The HYGAS plant in Chicago, Illinois, the CO_2 Acceptor plant in Rapid City, South Dakota, and the Bi-Gas plant in the construction phase in Homer City, Pennsylvania, are part of an Interior-American Gas Association accelerated program directed to acquire engineering data for the demonstration of a pilot plant by 1975.(8) The cost is shared with the government providing 80 million dollars and the gas industry providing 40 million dollars, and was first announced in President Nixon's Energy Message on June 4, 1971.(56) Neil P. Cochran of the Office of Coal Research believes 3 or 4 synthetic pipeline gas will be built in the 1970's in the U.S.(8) Environmental effects from plants are predicted to be minimal with discharge of some water vapor, carbon dioxide, and little heat.(56)

Work is continuing as well on development of clean synthetic liquids, and one synthetic oil plant with a capacity of 100,000 barrels could be built by the late 1970's. Possibilities also exist of combining oil and gasification production in one combination plant once experience is gained.(8) Detailed summaries of the status of all coal research projects is available from the Office of Coal Research, Washington, D.C.

The western coals present some problems, but are preferred for gasification and liquefication facilities due to the low cost and high recovery(80%) of strip mining coal.(33) Low availability of water is a major problem and is examined in another section of the report. The low BTU value of western coals is partially offset in the gasification process by its non-agglomerating characteristic that circumvents pretreatment.(33)

The natural gas shortage has been predicted to worsen and more companies are facing such an accurate shortage that they are considering construction of gasification plants using the Lurgi process, the only commercial synthetic pipeline gas processes currently available. The efficiency of 50-60% is lower than the 60-75% range of prospective newer processes, and problems exist in upgrading the relatively low heating value gas obtained.(33) Individual corporate economics will dictate feasibility of construction in the near future before the new gasification processes are perfected. Both Northern Natural, a mid-West utility, and Colorado Interstate Gas have evaluated Montana possibilities for such development.

The other principal area under investigation in Montana by utilities is the concept of mine-mouth power generation. The North Central Power Study was initiated by the Department of the Interior to study future power needs and resources of the North Central United States through the year 2000.(80). Nineteen investor-owned, six cooperative, two public power district, and eight municipal representatives were included. The study developed costs based upon mine-mouth thermal generating plants in Montana, Wyoming, Colorado, and the Dakotas. The 53,000MW total capacity would rely upon ultra high voltage transmission lines to deliver power to major load centers and the system could be tied to an interregional connection between East and West.(Montana Power and Pudget Sound Power's new plant will be 750MW) Of possible plant sites identified only 30% were in Montana, but Montana sites could generate up to 69,000MW with plants up to 10,000MW in size.

The actual site determinations would come at a later stage. The second phase of the project was to consist of utilities comparing developed cost data with their other possible future alternatives. System load factors, load forecasts, reliability, transmission, peaking conditions, and regional pooling are among the factors that must be considered in this type of planning.(44) An economic decision may then be made between the suggested generation of the North Central Study and nuclear alternatives for each company's system.

All participants were asked to respond by July 1, 1972, to indicate their interest in pursuing the project to feasibility and design stages. As of mid-August, 1972, only eight participants had replied to the regional Bureau of Reclamation office in Billings, and these responses were mixed as to feasibility of continuing the study. This apparent lack of interest does not mean the concept of power development in this manner is dead. Companies may prefer to proceed on their own without government participation.

The study has been severely critized because it considers only power generation and ignores synthetic fuel development. Certainly, it was also critized because the possible magnitude and impact of coal development was for the first time impressed upon the minds of many Montanans. The land, air, and water seemed suddenly to be used in one massive project. Much of the future of development depends upon the national energy situation and research approaches. We must now focus our attention at implications of national decisions related to energy and research.

DE-ENERGIZATION AND MISSED BOATS

> "Quite to the contrary, we believe that more, not less, electric energy is the answer to environmental problems."
>
> D. Bruce Mansfield, Chairman
> Edison Electric Institute(24)

The energy discussion thus far has assumed the continued increase in demand of over 5% in the late 1960's and 6% in 1970.(79) If this trend continues, there is no doubt that a national energy crisis in imminent, as illustrated by Dr. Linden's depletion statistics.(33) Other sources also point to the years when we will have depleted 90% of our fuel supplies; natural gas (U.S.) in 2015, crude oil (World) in 2020, and coal (U.S.) in 2400.(32) The nation began to sense the implications of shortages with recent brown-outs, a reduced power supply, and black-outs in various regions during peak load periods.

In light of the data on consumption and reserves, it is difficult to agree with the Chairman of the Edison Electric Institute that advocates more electrical energy use. The Edison Electric Institute is the principal trade association of the investor owned utilities, and its 185 member companies serve 77% of U.S. electric customers.(44) The concept of unlimited energy is also exhibited by Montana utility officials. A letter by Montana Power Company board chairman, J.E. Corette, states,"these coal reserves are so large that there is no conceivable possibility that Montana could ever use all of its coal."(11) The philosophy of the utilities is to provide as much energy as possible and reap the subsequent dividend. Nothing is wrong with this in the sense that the utilities provide a valuable commodity that is in demand.

If society finally recognizes that a national energy problem exists, it must act to reduce unwanton use of energy resources. Individuals must motivate a change in comsumptive philosophies exhibited by both the energy companies and general citizenry to moderate energy requirements. Efforts must be expanded beyond moderating electrical use because it accounts for less than 25% of energy consumption. The inefficiencies of motorized transportation for moving both people and goods in an obvious waste. We need motorized transportation, but not to the point of ignoring mass transit systems that would minimize our pollution, congestion on highways, traveler inconvenience, and energy consumption. The inefficient internal combustion engine consumes 16% of our energy budget, and freight trains get 2-5 times as many cargo ton-miles per gallon fuel as a truck.(32) A recent report of the President's Office on Emergency Preparedness suggested immediate imposition of energy conservation policies such as an energy-use tax, new building insulation standards, and discouragment of private auto use.(81)

Many national study groups have examined energy problems, but no coherent national policy has emerged to guide us. The lack of coordinated national energy policy in a sense endorses wasteful use and sporadic development of our natural resources. One outgrowth has been areas with many small utility distribution systems, and electric companies would rather construct new plants for profit rather than draw upon a coordinated national system.(30)

A bill to provide for a National Grid System to provide better utility coordination has been prepared for Congress, but utility opposition would appear to be substantial enough to stop the proposal. Senator Lee Metcalf of Montana, a bill sponsor, has cited the need for both a National Grid System and a National Energy Policy.(50) The development of a National Energy Policy must include intense public particiaption to insure that we are using our resources wisely. A total North American energy policy was envisioned by Walter Hickel, former Secretary of the Interior.(30)

Table 9.

Gas and Electric Power Industry Research*

Year	Total Operating Revenues	Research & Development Expenditures	Percentage of Operating Revenues
Gas Industry			
1968	$6,686,982	$7,965,601	.119%
1967	6,193,960	7,012,603	.113
1966	5,880,954	5,729,319	.097
Electric Power Industry			
1968	16,521,285	38,389,361	.232
1967	15,224,931	36,878,127	.242
1966	14,374,168	38,682,957	.269

*SOURCE: Magneto Hydro Dynamics (MHD), Federal Power Commission Hearing before Senate Committee on Interior and Insular Affairs, Part 2., Februrary, 1970.

The public utility campaign to advertise energy use, while at the same time pointing to hard-pressed efforts to meet needs, provides an obvious contradiction. The profitable returns of most utility companies, 15.4¢ on the dollar after expenses for investor owned utilities in 1968(49), are evidence of the rewards of this approach. The power company official would be a poor businessman indeed if he did not use it. If the public demands more power, higher rates will certainly suffice to provide more generating facilities. The question is whether utility companies with a monopolized market really need to manufacutre energy demand. Naturally, it is the public that pays for this free advertising as well since advertising is considered to be an operative expense and regulated utilities rates are based upon a "fair" rate of return. The State public utility commissions have not been responsive to considering this aspect of public interest. Consolidated Edison Co. in New York provided some inspiration when it disbanded its sales promotion department and announced plans to use its advertising budget to urge conservation of electricity.(80)

As research in any field, is vital to insure the best technology, one might assume that electric and gas utilities are doing their best to research improved systems. The total research budget for utilities were shown on Table 9., and much of this went to the improvement of current systems. The consumer naturally pays this bill as well, but the absurdly low research level of utilities in 1968 was only one-sixth of their budget of $273,777,000 for advertising. Of the 212 major utilities, who netted 15.4¢ on the dollar after all expenses, 51 did not spend any amount for research and development.(49) A survey by the Engineer Manpower Commission of the Engineers Joint Council, published in the May-June 1969 issue of Engineer, found the utility industry the worst equipped of any for doing advanced research according to the criterion of the number of PhD's employed.

Montana-Dakota Utilities did not spend anything for research inside or outside of the company and spent $365,705 on sales according to its own report in Statistics of Privately Owned Utilities, 1968.(49) Montana Power Co. spent $23,443 on research in 1968 compared to $483,281 on sales. Both companies have raised their research budgets recently. In 1971, Montana Power spent $116,221 and Montana-Dakota Utilities spent $29,931 according to the Montana Public Service Commission.

The opportunities that have been slowed and foresaken due to this lack of effort are appalling. The story of magneto hydro dynamics (MHD) is a technology of power generation that offers advancements as exotic as its name. It would provide low cost power, conserve energy resources, negate many pollution problems, and provide a rapid start advantage. MHD has potential of 50-60 percent compared to 40 percent for the best steam plants and 33 percent for the best nuclear.(56)

MHD is dependent upon an easily ionized metal, such as potassium, becoming expanded to high velocity in a high temperature combustion gas. This mixture is directed into a magnetic field and power is generated by the interaction.(16) Faraday observed this effect over 100 years ago, but development has been hindered by research with the high temperatures required.

The pollutant emission advantages of a typical minimum sized 1,000 MW MHD pland versus a steam power plant is illustrated in Table 10. Heat emission would be cut by over one-half compared to steam plants because of the higher cycle efficienty.(63) A maximum of 40% of conventional steam plant cooling water would be required(2), and eventually little of no water might suffice.(56) The minimal water requirement would enable western coals to be more readily utilized. Detailed cost estimates of eventual MHD plants have been shown to be 30% less than for a conventional steam generation plant.(16)

An excellent summary of MHD research, potential dollar savings, and integration with breeder and nuclear technology, is provided by Professor James Dicks of the University of Tennessee Space Institute.(16) Professor Dicks outlines, and easily justifies economically, a ten year 282 million dollar research program. An MIT study group, in a report prepared for the Office of Coal Research, estimated a much lower cost of 108 million dollars for a ten year program.(57) However, the history of MHD research support reads like the story of a stagnant stream.

AVCO Corporation designed the first small MHD generator in 1959, and by 1965 in a joint utility ten million dollar program, had solved most of the basic problems for short termed generation.(38) Some interest in development of systems to meet peaking demands developed, but from 1965 through 1970, progress was virtually halted towards an experimental MHD plant for power generation.(38) Finally federal government support was obtained in June, 1971 for a 2.5 million dollar two year program between the Office of Coal Research and AVCO Corporation. Federal funding was, with utilities providing a $450,000 pittance the first year, 1.5 million dollars in fiscal year 1972, and 4 million dollars was expected for fiscal year 1973.(21)

Montana's Congressional delegation are leading advocates of the technology, and it will obviously take supreme efforts to raise the required funds to attain the pilot plant stage. Utility participation is hoped for. In the meantime the Soviet Union has constructed a 25 MW gas fired MHD plant as part of a 200 million dollar program, West Germany efforts are two to three million dollars per year, and Japan is conducting a experimental program.(16) In Montana, Professor Lloyd Berg of Montana State University, has a research contract with AVCO for experimentation on MHD with western coals, and he has submitted an application to the Environmental Protection Agency for a larger project grant.

Officials of utilities and the federal government insist that they wish to insure that Montanans will bear but minimal burdens from air and water pollution as a result of power generation. Utilities and the public want low cost power generation requiring minimum investment. Conservationists and utilities alike wish to have our coal and water resources used wisely. Montanans wish to provide national leadership in insuring the proper development of its resources. There should then be unanimity in support for a State law to have the effect of preventing further construction of steam generation power plant in the State of Montana. We should simply wait for MHD.

Other energy alternatives have been similarly ignored from solar energy to windmills. Faith has been placed in the development of the breeder reactor and other nuclear alternatives. The bulk of the 260 million dollar U.S. energy research budget is devoted to the development of breeder technology, and the AEC is setting a goal of 1980 for operation of a 500 million dollar demonstration plant.(20) It has been estimated that with optimum estimates of fuel doubling time of ten years and projected uranium shortage that 30 years would be required to satisfy the nation's power needs. Adding ten years for development and ten years for siting and building the first system, yields a 50 year time horizon before the nation's total needs could be satisified from breeder technology.(16) This is assuming public acceptance can be gained of a technology that must deal with deadly radioactive substances and waste. The ideal source of fusion power through joing of atomic nuclei would provide unlimited energy, but experts do not expect initial development until 1990 at the earliest.(20)

Until the realization of safe nuclear energy, it is apparent that we should not close our eyes to problems of increasing energy demand and feasible alternatives of energy generation. Only by achieving a national perspective on energy, through a National Energy Policy, can we insure that we are properly making use of our resources. We might then be able to better establish research priorities. Energy companies and the American people alike might then know how they could best help to meet the most basic need of a prosperous nation. Action by calling for additional studies will be equivalent to no action at all.

Table 10.

Comparison of Stack Emission (in tons per day)
From Conventional Steam Power Plants and MHD Power Plants
(1,000 MW, Coal 3% sulfur)

	Conventional Steam	MHD
Particulated Matter	33 (a)	3 (b)
Sulfur Oxides (SO_2)	450 (c)	3 (d)
Nitrogen Oxides (NO_x)	80 (c)	4 (e)

(a) Recommended dust emission control in accordance with ASME standard No.APS-1, November, 1968
(b) 99.9% efficient seed recovery and gas clearing system(achieved in Russion pilot plant(31)
(c) Emission factors from Public Health Service publication No.999-AP-Y2
(d) 25 ppm SO_2 in effluent gas from chemical recovery system.
(e) 50 ppm NO_x in effluent gas from chemical recovery system.

SOURCE: Enviornmental Pollution Control Through MHD Power Generation, AVCO Corporation, May, 1971.

IT'S THE WATER

> "It is virtually an indiscriminate scramble for water rights without regulation or even an intelligent idea of what they really require... A radical change in our present water rights laws, placing the stream flow under the supervision and control of the State seems necessary to meet the changing conditions......."(16)
>
> Archie Mahon, State Engineer, 1912

The water requirements for the coal industry in Montana have been summarized in the well publicized Bureau of Reclamation Aqueducts study released in April 1972.(78) The estimated wide range of coal and water requirements cited in this study are consistent with those found elsewhere and are given in Table 11, with noted adjustments. Dr. S.L. Groff of the Montana Bureau of Mines estimates as many as 15 combination plants could be built considering coal and water availability.(27) A Bureau of Mines study estimates a combined total of 17 plants for Montana in 2020.(75)

The proposed Aqueducts study routes are given in Figure 3. The proposed development projects to generate over three million acre feet of water supplies in the Yellowstone Basin are given in Table 12. This is based upon flow in the DRIEST YEAR, like 1961, when the average annual flow of 8.8 million acre feet might drop to 4-5 million acre feet.(22) It was expected in the study a maximum of 2.6 million acre feet would be needed for coal processing based upon current water options of 700,000 acre feet, requests on file for 1,100,000 acre feet, and 800,000 acre feet required for the plants in the North Central Power Study. This overall development estimate is somewhat higher than a Bureau of Mines study estimate of 1.5-2.2 million acre feet for development.(75)

In a normal year there would still be 6,200,000 acre feet in the Yellowstone for other use. Even in the dry years planned for in the Aqueducts Study, there would be 1.7 million acre feet of water still leaving Montana. THIS IS AFTER TAKING INTO CONSIDERATION PRESENT AND POTENTIAL IRRIGATION IN THE AREA. Even if those potentials were considered low by some, there would still be water for development. Agriculture would ultimately benefit as the aqueducts might provide water storage and transportation to new areas after industrial purposes were served. ALL WATER WAS APPORTIONED ACCORDING TO THE EXISTING YELLOWSTONE RIVER PACT OF 1950 THAT APPORTIONED WATERS ACCORDING TO TABLE 10. A resource inventory and potential development needs of the 26 eastern Montana counties have been summarized in a recent Bureau study.(77)

The biggest flaw in the Aqueducts Study was the consideration of construction of Allenspur Dam on the Yellowstone River above Livingston. The construction of a dam in such a fine scenic and agricultural area brought into question the Bureau of Reclamation's damming sense of values and jeopardized many of the studies' original intentions. As the Aqueduct Study and Table 12 note, the required storage can be provided by off-stream reservoir and Allenspur is not required. The Aqueducts Study can also be critized for not considering possible

Table 11.

Estimated Coal and Water Requirements
For Conversion Processes

Process	Coal	Water
Thermal Electric Plant using Cooling Water (1,000 MW)	5,000,000	9,500-17,000
Gasification (250 Million Cu.Ft/day)	6,500,000	20,000-30,000
Hydrogenation (100,000 barrels synthetic crude/day)	15,000	20,000-65,000
Combined products (50,000 barrels crude daily, 250 million cu. ft. gas, 1,000 MW electricity	12,000-18,000	50,000-75,000

SOURCE: Montana-Wyoming Aqueducts, Bureau of Reclamation, 1972.

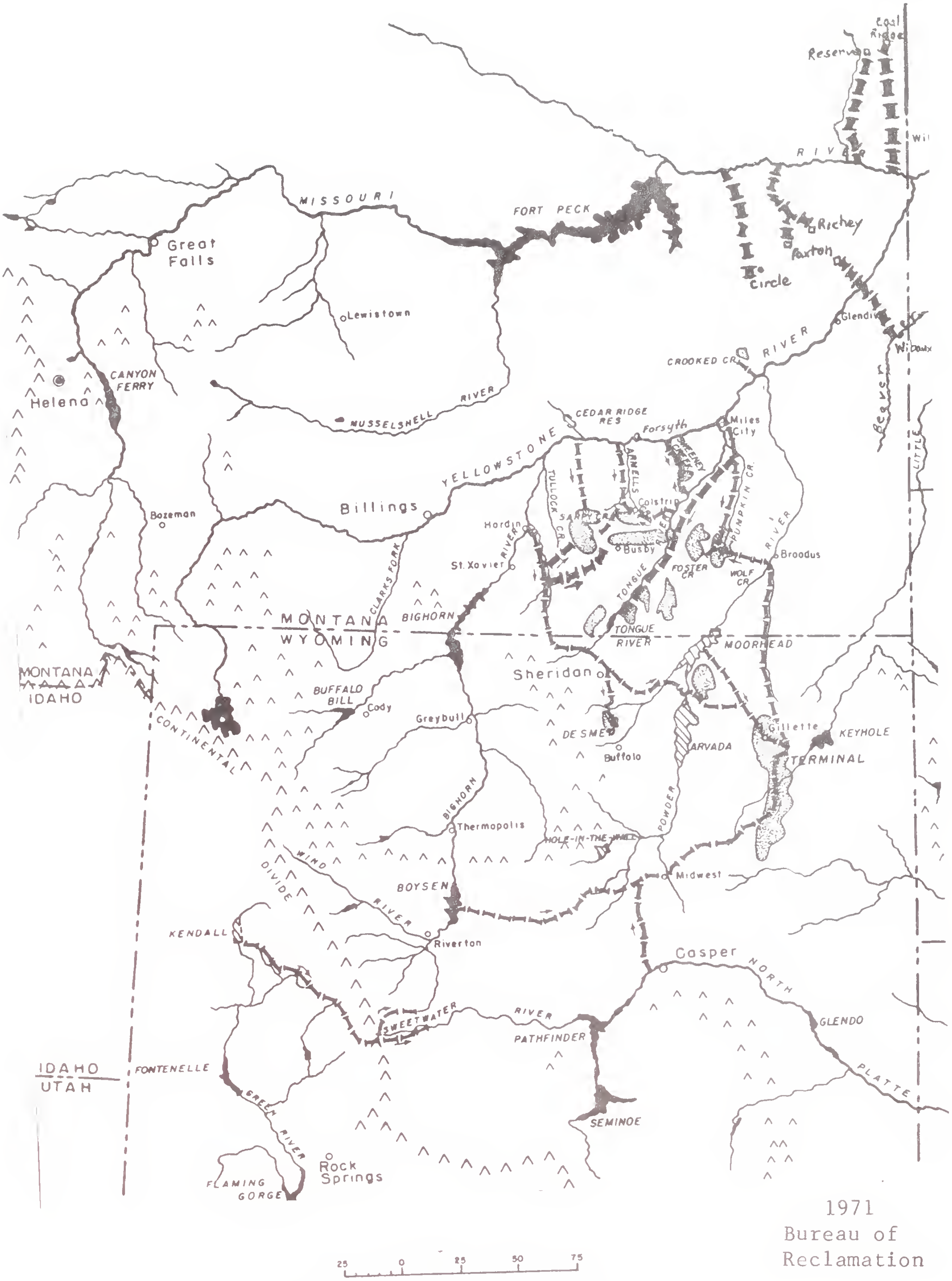
recreational and agricultural uses of water. Since 26% of the intended water use was for electrical generation, a substantial portion of this would not be needed if Montana chose to wait for MHD technology.

The Aqueducts Study was only preliminary and funding is now being sought from Congress to do a full feasibility study. This feasibility study should be supported for the following reasons: (1) beneficial use will be made of Montana water. Only beneficial use can insure that Montana will have the right to use these water now and in the future, (2) It will insure that decisions of routing will be done by a public agency where the public may have greater inputs into planning, (3) the Bureau of Reclamation would be more likely to fully assess environmental impacts of proposed routings that private development, (4) coordinated water transport will minimize number of private developments and thus minimize envrionmental impact, (5) possible future benefits may accrue to currently non-irrigated areas, (6) the added water would help prevent a hurried scramble for Montana water rights, and (7) reservoirs could provide for flood control and potential recreation sites.

Naturally, the above rationale are based upon the assumption that other development problems can be solved.

It must be noted that the industrial use of Missouri Basin and Fort Peck waters has not been studied at this point in time. However, it can be anticipated that such studies will be made, and this water will further insure that adequate supplies will be present for industrial use. The Montana Water Resources Board reported that about 9.97 million acre feet of water originates in Montana in the Missouri Basin.(53)

Figure 3.



1971
Bureau of
Reclamation

MONTANA-WYOMING AQUEDUCTS

STUDY ROUTES

Table 12.

Summary of Industrial Water Resources

	ACRE-FEET			
	Available		Potential	
	Montana	Wyoming	Montana	Wyoming
Bighorn and Wind Rivers				
Boysen Reservoir		85,000		50,000
Bighorn Lake	262,000	435,000		254,000
Little Bighorn Reservoir			40,000	
Powder River				
Moorehead Reservoir			57,000	51,000
Hole-in-the-Wall Reservoir				20,000
Tongue River				
Tongue River Reservoir			60,000	
Other development with major storage				60,000
Yellowstone River				
Main stem(with regulation by offstream reservoirs, or Allenspur)			1,356,000 1/	344,000 2/
Shoshone River				
Modification of Buffalo Bill Reservoir				50,000
Green River				
Importation and diversion				108,000
Total	262,000	520,000	1,513,000	937,000

1/ about 1.7 million acre-feet would remain in the Yellowstone River for other future development and for minimum flows.

2/ Wyoming's share of Clarks Fork Yellowstone River.

SOURCE: Montana-Wyoming Aqueducts, Bureau of Reclamation, April, 1972.

Table 13.

Yellowstone River Pact Apportionment

	Montana	Wyoming
Clarks Fork(Yellowstone)	40%	60%
Big Horn River(exclusive of Little Big Horn River	20%	80%
Tongue River	60%	40%
Powder River(including Little Powder River	58%	42%

SOURCE: Water Laws of Montana, 1965 (52)

The only option on this water for coal development purposes was a 50,000 acre feet option by the HFC Oil Company of Casper, Wyoming. HFC has requested the Bureau of Reclamation for estimates on construction of appropriate aqueducts to 35 miles North of Bloomfield in Dawson County.(7) Over 100,000 acres of coal land has been leased in Dawson County where company officials estimate one billion tons of coal lie, 80% of which is strippable. HFC will not develop properties, but will sell rights to major companies. The area is foreseen to be developed primarily for gasification facilities, and mining for shipment could also occur.

WATER RIGHTS

One advantage of the aqueduct concept is to help prevent a scramble for water rights. If all development of storage facilities proceeds, then most demands for water should be met. However, the future of the aqueducts proposal is uncertain, and it is apparent that the race for water rights has started. Unfortunately, the statement of Archie Mahon, State Water Engineer in 1912, aptly notes the inadequacy of what is still our method of water rights regulations. Montana's whole water rights structure is based upon the concept that there is no problem until we have no water. Montana's water laws are complex, and cited sources should be consulted for completeness and clarifications. However, and understanding of a small segment of water law can reveal a few of the problems.

Water rights in Montana depend upon whether an individual is making beneficial use of the water and whether an individual is first in time to make beneficial use.(42) The first person to make beneficial use of the water is entitled to the water right, but after he has made proper use of the water he must return the remainder back to the stream. The water right entitles you to use of the water, but it does not entitle you to ownership, as no one person owns the water.(39) This doctrine of appropriation provides that a person may appropriate water by completing a ditch or by posting and filing notices on water rights. One could divert the entire flow of an unadjudicated stream as long as the water was put to a beneficial use.(42)

The filings on the water rights in county courthouses provides an incomplete record of appropriations on unadjudicated streams. This is because there is no limit to the water rights claimed, and the rights need not be filed at all.(66) The result has been the over appropriation of Montana streams. For example, the Big Hole River with an average flow of 1,000 cfs has filings totaling 172,912 cfs!(66) Water still flows in the Big Hole, but it is only after a user finds himself short of water that the proper appropriations will be made.

Water rights are adjudicated in the State by the District Court that issues the "decreed" water rights. The decreed rights are the result of a water suit where priorities are accorded to the various claimants according to the time of first benefical use.(42) The process of determining proper claims and ownership or all parties on a stream, from the first settlement of an area can be long and laborious, particularly since county records cannot be relied upon. Once the decree is given the Judge of the District Court must, on petition of 15%

of the water rights affected on a decreed stream, appoint a water commissioner to measure and distribute the water. (66)

The major problems associated with this procedure are three-fold; (1) decreed rights are uncertain and are usually determined only after problems arise, (2) it is a cumbersome procedure with high court costs, and (3) courts are not the best water rights administrators.

The first major weakness simply points to the fact that it is much easier and beneficial to avoid problems before they arise. When a point in time is reached that all of the rights on a stream have been appropriated, it is apparent that it should be determined whether all rights are proper and legal. If appropriations were legally made at this stage, rather than years later when memories fade and recorda are lost, we might have more stability and faith in water rights decrees. Indeed, Professor Albert Stone of the University of Montana Law School has stated that there are no adjudicated streams in Montana!(71) No process is available whereby a final allocation of water can be made. Professor Stone cites the example of Dempsey Creek, a small stream in Powell County of less that 14 miles in length, where there have been fourteen lawsuits with eight decisions by the Montana Supreme Court.(72)

Professor Stone notes that adjudication proceedings do not require all persons on a stream to be named parties to the court action.(71) Thus, persons who maintain they have superior claims do not have to come forward and may, many years later, initiate court action upon their claim. Finally, in a court proceeding, a party does not have to litigate all of his claims, and this results in the further possibility of actions at a later date.(71)

Secondly, high court costs and long proceedings are an inherent part of the present process. Judge W.W. Lessley of the 18th Judicial District has noted that the smallest of suits may take from three to four months to try.(39) Litigation for the past twenty years over water rights in the Beaverhead Valley have reportedly cost nearly one-half million dollars.(66) Some have observed that there have been relatively few water rights cases in recent years. This may just as likely reflect a poor and unpopular system of water right determination as the absence of water rights problems. Considering the costs and delays of court, the prospective losses in court of time and money might easily outweigh the losses of water.

Judge W.W. Lessley noted in 1950 that he did not feel that the District Judge should administer the water rights.(40) The water commissioner is often appointed only after a shortage is present and temporary positions maybe difficult to fill. Streams crossing county boundaries also create administrative problems.(66) It is interesting to note that under the current administrative system an excellent qualification for District Judge is to know the location of every water diversion ditch in the district.

Montana is the only one of 17 western states failing to adopt a water rights system patterned after either the Wyoming or Colorado system. This could probably only happen in a State where there has been no serious water shortage thus far.(19) Water demands of coal development underline an impending water shortage and the inadaquacy of Montana's present water rights system.

Montana's new Constitution directs that a central filing system for water rights be created. However, this is only one step and could amount to simply keeping a record of confusion. Montana needs water rights determination by an administrative body that would act after gathering pertinent data and before an acute water shortage exists. Such a body should bring expertise to bear upon the problem and hold hearings before determinations were made. Provision should also be made for judicial review of administrative allocations.

Similar systems used in other states provides more certainty in water rights decisions. We may solve water rights problems before the streams run dry. The courts would not be burdened with administration and could properly hear appealed administrative decisions. Delay and high court costs would be greatly reduced.

According to the terms of Congressional legislation, a 10 year moratorium on transfer of water to the Colorado River Basin was declared in 1967.(66) Over half of the moratorium has passed with Montana failing to establish beneficial use of its waters. Only by establishing Montana's water use through complete records can Montana expect to retain water rights. Montana can establish such records only by moving towards a modern and efficient method of administration.

LAND RECLAMATION AND AIR QUALITY

> "As a society and as individuals, we must consider the alternatives and make the commitments that will produce the greatest net benefit in managing our environment."
> U.S. Chamber of Commerce Panel (61)

Montana's law of eminent domain enables the owner of mineral rights to recover minerals regardless of surface ownership. At least 12,000,000 acres of privately owned land in Montana has mineral rights reserved to the U.S. government.(55) Thus, many Montana landowners have no choice as to whether their lands will be mined. The owner of the land is entitled to just compensation through due process of law. In come cases land maybe leased, although mining companies prefer ownership to leasing.

The Landowner Notification Act was passed by the 1971 Legislative session and helps to protect landowner interests in prospective mining endeavors. The act provides that all prospectors contemplating any mechanical operations that would cause surface disturbance must receive written approval from the land owner for such operations.(68)

Dr. S.L. Groff of the Montana Bureau of Mines estimates that 200 square miles of land will be strip-mined in Montana in the next 50 years. This is based upon a six billion ton demand with seams averaging 30 feet thick and 30 million tons per square mile.(28) Landowners' lack of control over development makes concerns about reclamation even more significant.

Land reclamation is the most troublesome and publicized problem related to coal development by strip-mining methods. No attempt will be made to evaluate the history of strip-mining and reclamation problems. It will suffice to state that history conclusively shows that industry requires governmental regulations to insure the land will not be left in spoil piles. Mr. Edwin Phelps, President of Peabody Coal, has noted that the coal producer who diverted profits to reclamation was at the mercy of competitors due to the intense price competition.(60)

Montana's first strip mining law went into effect in 1968 and was know as a voluntary contract law. Reclamation was encouraged by granting tax credits up to one-half the cost, but a reclamation contract was not required. In 1971 the Montana Open Cut or Strip Mine Reclamation Act was passed. It requires a reclamation contract with the State on all surface mining operations that are expected to remove 10,000 cubic yards or more of coal, clay, bentonite, uranium, phosphate, sand, and gravel. The law applies to all private, State, and federal lands, but Indian lands are a possible exception.(26)

The current reclamation law requires that a detailed reclamation plan be submitted to the Department of State Lands. A seven member advisory committee representing different State agencies, the landowner, and State archeologist review the plan before the State Board of Land Commissioners takes action. The Commissioners have 60 days to act, but may extend the review period an additional 60 days. The contract states that the Commissioners are required to approve only those plans providing "for the best possible reclamation procedures available under the circumstances at the time, so that after mining operations are completed, the affected lands shall be reclaimed to a productive use." A vegetative cover appropriate to the land use is sought.

A bond from $200 to $1,000 is filed for purposes of restoration should the operator fail to fulfill terms of the reclamation contract. Anyone who engages in operations without a contract is subject to penalties from $500 to $1,000 a day. Appeals on decisions of the commission are allowed the operator and maybe taken to the District Court.(67)

The best possible reclamation procedures available has been interperted by administrators of the law to mean the salvage and reuse of topsoil. Decker Coal Company, Knife River Coal Company, and Western Energy, have all agreed to provisions of the 1971 Reclamation Law as they had been previously covered under the voluntary act. Peabody Coal has been reluctant to agree to new standards primarily because of the topsoil issue. Peabody maintains topsoil is too sparse to save and other soils may enhance growth as well. John Goers, Administrator of the Reclamation Division of the Department of State Lands, believes topsoil significantly hastens revegetation and should not be prohibitively expensive to save.(26)

Given the current status of reclamation law in Montana, the question of its adequacy can be examined. To assess the present law's adequacy we must first define specific goals that are desired in any reclamation effort, and we may then determine if the law is functioning to meet those expectations. It would seem that the goal of reclamation most often stated is one that is simply expressed. We wish to reclaim the land to its original or better use in a reasonable time.

This goal is stated because landowners wish to return to operation with the land as productive as it was before mining. This is a legitimate goal of society as well, since land in rural counties is the most important factor in the area's economic base. The individual's and counties' livelihood is based upon the land and its use. If land were not restored to like value before mining, an individual or society itself would ultimately pay a deferred cost similar to that now imposed by leveling and reclaiming old spoil banks.

If original use is the accepted goal of reclamation, the implied is the consideration of the land's total value. This means that the land's beauty and esthetics, recreational benefits, archaeological stores, and wildlife habitat must be considered as well. Land use implies many different types of uses by man and nature. These difficult questions of value must be assessed in terms of whether the goal of original use in its full context can be reached.

Much, naturally, depends upon the capacity for current reclamation research to restore the land. A reasonable time for a coal company might be twenty years, and the land would restore itself unaided. Society wishes the land to be restored by hastening natures processes. The results of reclamation work in Montana are sparse due to the few years experience we have had in strip mining operations. Due to Montana's dry climate and relatively thin soils, research from other states is generally not applicable.

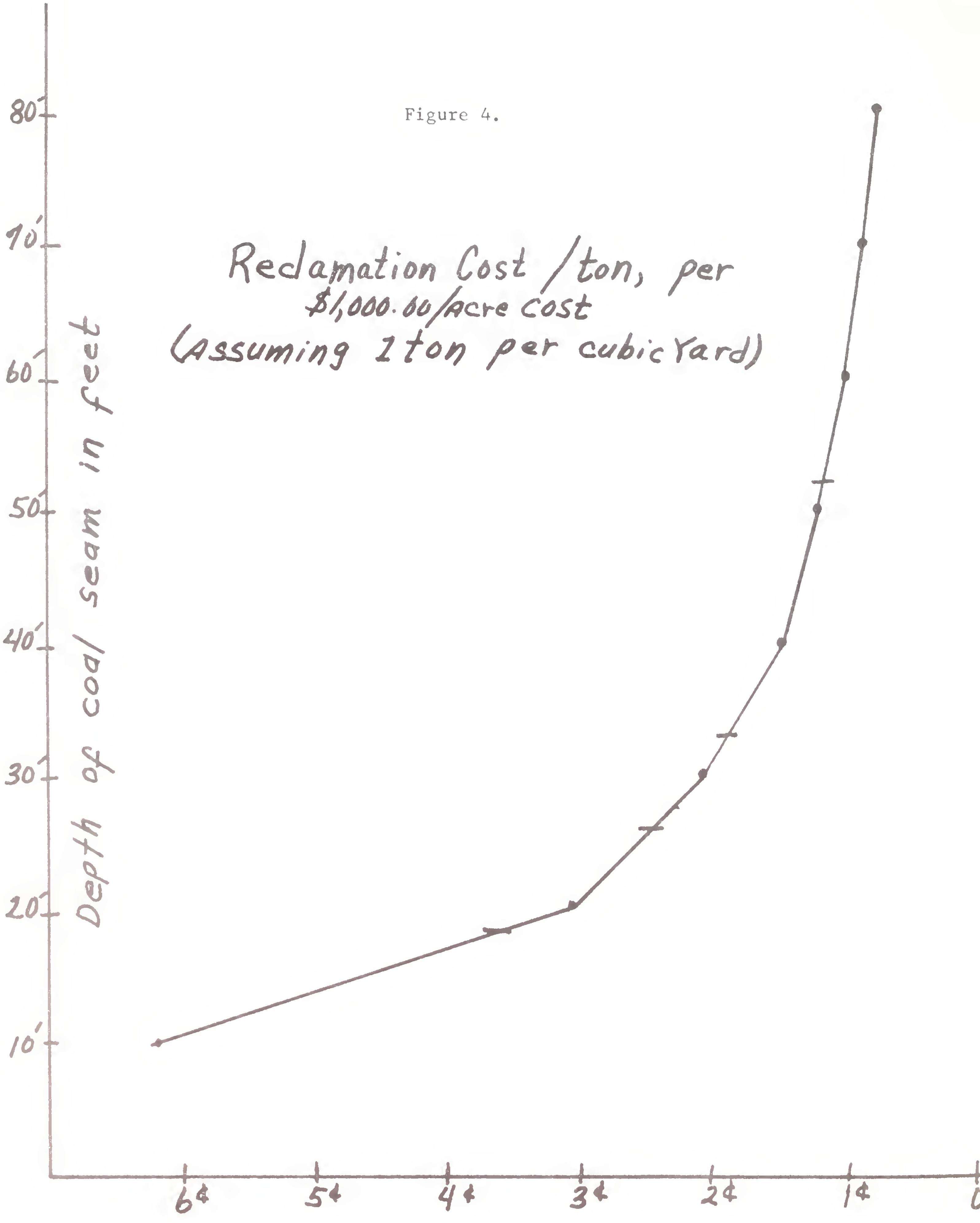
The most extensive research on revegetation is being done by the Montana Agricultural Experiment Station at Montana State University. Research supporters have included Western Energy Co., Peabody Coal Co., and Decker Coal Co. A 1971 progress report summarized progress on treating raw spoils, water quality analysis, fertilization rates, and mechanical surface manipulation.(31) The general research program calls for soil moisture, compaction, seeding, fertilization, and grazing studies. No real conclusions have been reached as to feasibility, time and cost of returning land to range, the major use of land in the areas under study. This uncertainty in research was noted by Fish and Game Director Don Brown relative to safety of wildlife.(24)

Research in other states is not generally applicable to Montana because of the precipitation factor. Thomas Gwynn, Geologist of Knife River Coal Co. notes that spoils in Montana do not give off acid waste that has been a problem in other parts of the country.(29) Also, land values in Montana are far lower than many areas being mined in other states. This makes the land more attractive for mining purposes and alleviates several economic problems experienced in other states.

Costs of reclamation also varies greatly according to type of land, climate, and purpose desired. The American Mining Congress reported on five of its own studies and four typical Bureau of Mines studies, where costs ranged from $349 per acre to $8,115 per acre with an average cost of $1,852 per acre.(58) Although still uncertain, cost of reclaiming Montana lands is thought to be much less. Reclamation is a small portion of total coal cost when cost is expressed on a per ton basis rather than a per acre basis. The true cost relative to production maybe seen. If coal were mined from a typical 20 foot seam and even $2,000 an acre was spent on reclamation, the reclamation would add only 3¢ in cost to a ton of coal, according to Figure 4. This compares to 20¢ per ton paid by Peabody Coal to the United Mine Workers Welfare and Pension Fund. Since coal in Montana at the mine is roughly worth $2.00, reclamation would only be 1.5% of the cost at the mine. As freight rates average about $8.00 per ton for Mid-West shipments, the reclamation costs in this example would be four-tenths of one percent the power plant coal price. The cost is actually less because the company receives one-half its reclamation cost as a credit to its coal mine license tax. Taking this into consideration would yield a reclamation cost of less than two-tenths of one percent the total cost of Mid-West coal.

The indefinite nature of research efforts has been noted. Sound reclamation laws should still be written to provide insurance that the major reclamation goal of society is being reached. It is then industry's responsibility to meet these requirements. Society must fix a price to the use of land, and in this case the price should be reclamation to original or better use. Society acutally pays the price as well, since one-half the reclamation costs are deducted from coal mine license taxes, and the public buys the energy. If industry could dedicate itself to this challenge, it would perhaps be welcomed

Figure 4.


Reclamation Cost /ton, per
$1,000.00/Acre Cost
(Assuming 1 ton per cubic Yard)
Depth of coal seam in feet
80'
70'
60'
50'
40'
30'
20'
10'
6¢
5¢
4¢
3¢
2¢
1¢

in more quarters. The coal industry and utilities provide one of society's greatest and most basic needs, but they should fill the needs without sheltering hidden costs.

Montana's reclamation law will probably have suggested changes in at least three major areas at the 1973 Legislature according to John Goers of the Department of State Lands.

1. Authority for the Department to selectively deny strip mining of certain areas. This provision is certainly essential for consideration of lands too steep for proper reclamation, valuable archeological sites, and important recreation areas. A well balanced law must offer the alternative of no mining at all if such mining would be unable to reclaim areas for original use. The burden of proof must be placed upon the mining operator.
2. Authority to regulate mining methods. A provision is certainly needed to regulate methods to insure proper reclamation. This is particularly true as more sophisticated methods such as auguring become introduced into the State.
3. A new definition of soil to provide for topsoil cover. Great value should be placed on rate of revegetation, and as topsoil enhances growth, this change should be supported. Alternatives to topsoil should be left open to the company, but the burden of proof should be placed upon the operator.

Besides these suggested additions on reclamation law, consideration should be given to the following to insure that the reclamation goal is met:

1. The definition of reclamation should be changed from "reconditions of the area....for productive use"....to(a) reconditioning whereby it can fully serve its use before mining or be put to a better use and (b) specification of a stable vegetative cover consisting, wherever possible, of native vegetation.
2. Provision for appeal of the Commission's decision to a district court by affected landowners.
3. The maximum bonding limit of $1,000 per acre should be deleted as research is not conclusive on this point, and g reater bonds might be required in some areas.

As experience is gained with current laws, more detailed specifications should be able to be made concerning reclamation and mining method. It must be remembered that an agency dedicated to the public interest is as important as the law itself, and Montana has been fortunate in this respect.

The federal government is considering strip mining legislation in both the House of Representatives and the Senate. The benefits from federal legislation could be great, but only if the law is of a fairly strict nature. This could significantly reduce problems with states having either weak or no reclamation laws. Montana should still be able to operate under more strict standards than federally imposed legislation if it so desires.

A resolution to ban the strip mining of coal has been approved by several Montana groups including the Birney Land Protection Association, Bull

Mountain Land Owners Association, and Northern Plains Resources Council. These groups maintain that underground mining can compensate for strip mined coal, but a sound reclamation law should meet many of these group's goals while still providing a needed source of energy.

AIR QUALITY

The problems associated with air quality have been partially covered in previous sections. The Office of Coal Research has stated that the gasification process was to have few air polluting characteristics, and this is thought to be true of future hydrogenation plants as well. The major concern over air pollution lies with steam generation power plants, and this report recommended that no future steam generation plants be built in favor of advantages offered by MHD and breeder systems.

The alternative of coping with steam generating plants might deserve some discussion for those who feel that an outright ban would not be politically feasible. The most enlightening comparison is that of the Four Corners Power Plant experience in the southwestern desert near the junction of Colorado, New Mexico, Arizona, and Utah. The plant originally started operating in 1963 at 575,000 kilowatts and the total projected generating capacity was put at 13.9 MW. The only problem was that initial units operated with an inefficent 78 percent efficient emission control system of obsolete mechanical particulate controls. As a result the development spewed out 200-250 tons per day of wastes into the desert air. A 1970 report by the Department of Health, Education and Welfare concluded that the design could have included 99% particulate control of similar plants and the precipitators on units four and five were about one-third too small.(84)

The desert polluter became widely publicized, but is was not until 1970, after several government investigations, that the installation of a wet scrubbing system and baghouse filters was projected to lower particulate emissions from 250 to 30 tons per day. U.S. Senate hearings were held on the problem and New Mexico Senator Joseph Montoya estimated eventual daily emission from all plants at 200 tons of particles, 850 to 1,300 tons NO_x and 2,000 tons of SO_2 with presently envisioned pollution controls. The plants will use much of Colorado River water to produce power primarily for southern California and major Arizona cities.(84)

Sulfur dioxide has long been recognized as one of the most damaging pollutants to vegetation, property, and human health.(1) Effects of other pollutants such as cadmium are not fully known. If Montana is to experience growth in steam generation power facilities, it should carefully consider environmental effects by providing base studies of potentially affected areas. Promising predictive techniques to assess SO_2 damages on plants and property have been used by Richard Stroup of Montana State University and Barry Asmus of Boise State College.(1) They assessed SO_2 damages from the American Smelting and Refining Plant in East Helena by use of a computer model. Such techniques hold promise for providing just compensation for those affected by pollutants.

More stringent federal standards were recently approved and State control has been exercised through the State Board of Health. The new Montana Power development at Colstrip will include a wet scrubbing system and will reportedly meet federal and State emission and ambient air quality standards. The question of power plant siting is covered in the coalinization section as one further means of planning for such development.

ECONOMIC ASPECTS OF DEVELOPMENT

> "The absence of important cities in the Plains proper and Plains states generally, means such population will move out of the states and the region."
>
> Carl F. Kraenzel(37)

The words of a well-known Montana sociologist note the obvious lack of major trade centers in eastern Montana. There are not many major cities simply because the economics of the area will not sustain such development. Some Montanans have become confident that the coal boom will mean the revitalization and start of many major population centers. Much negative reactions has been directed at widely publicized predictions of 200,000 to 600,000 new people in eastern Montana. Such predictions are unfounded, but before the impact of the development is assessed, the present economic condition must be summarized.

Present Economic Condition

For purposes of analysis only, those counties with over 500 million tons of strippable coal according to Table 4 were considered. These eight counties where major impact will occur are Big Horn, Custer, Dawson, McCone, Powder River, Richland, Rosebud, and Wibaux. The total population of these eight counties was only 56,571 in 1970 with a density fo 2.25 persons per square mile. From 1960-70, the eight counties experienced a 5.3% loss in population from 59,743 to 56,571.(69) The 1968 per capita income ranged from a low of $1,932 in Big Horn County to a high of $4,143 in Dawson County.(69) The net out-migration was calculated at an average of 16.1% from 1960-70.(82)

The Montana Economic Base Study by the Bureau of Business and Economic Research at the University of Montana in June, 1970, provides projections for several areas. Seven of the eight counties under consideration fell in the Bureau's Region III and Region Vi, comprising the 14 Eastern Montana counties.(71) The Bureau noted the decline in Agriculture in Region IV from 1950-68, and projected a continued decline in Agriculture. The 1980 projection for Region VI was for a 3.9% increase of 1,300 persons due to a growth of all industry jobs and coal industry jobs. New coal mining jobs were put at less than 400 by 1980 due to the high worker productivty, and all utility jobs were estimated to increase by 400.(5) Region III was projected to have a 14.2% population decrease with the declining job picture in Agriculture being primarily responsible.(4)

The study clearly indicates that Agriculture will continue to decline because of increased productivity and farm prices, and there are few other sectors that may absorb this loss of employment. This is the general picture that the counties in the area must face, but one might try to assess possible implications of development on the individual counties. As an example, one might look at the economic effect of coal development at Colstrip.

Impact of Current Developments

Table 14. shows the great increase in coal mining revenue. This is exclusive of taxes paid by employees, railroad property, and substantial indirect benefits from having a larger number of primary jobs in the area. Counties receive taxes on the property of mining companies, the net proceeds derived from the millage levy assessed against value of tons mined, and taxes on royalties paid to the coal rights owner. The increasing tax contribution of direct coal mining taxes is shown in Table 15. The potential impact of the investment of 200 million dollars for annouced Colstrip power plants will have even greater impact. The investment would yield a taxable valuation of 24 million dollars ($200 million times .4 [assessed] times 13 [tax rate]). The mill levy is applied to the taxable valuation to yield taxes payable. The taxable valuation in Rosebud County last year was about $18 million. Therefore, the total valuation after development of $42 million considering only the plants themselves would represent 2.3 time the present taxable valuation.

The investment in one 250 million S.C.F. per day gasification plant has been estimated at $250 million.(17) The total taxable valuation of such an investment would be $30 million. ($250 million times .4 [assessed] times .3 [tax rate]) The total taxable valuation of the eight primary coal counties was $121.6 million in 1970.(70) One gasification plant would represent about 25% of the total taxable valuation of all eight counties combined in 1970.

Some counties fear that the passage of the new Constitution will mean the end of the valuable net proceeds revenue because the new Constitution does not specifically mention the net proceeds tax. This fear seems to be unwarranted as the net proceeds law is still on the statute books, and the counties should be able to justify use of net proceeds for needed services if any change in law is suggested. Actually, the income from net proceeds is highly variable as it is based upon proceeds minus deductions. Counties should ask for a gross proceeds tax that would be based only on mine production. This would provide a much more consistent revenue base.

Impact of Future Development

The economic effects in terms of primary employment, derivative employment, retail business, construction, and other obviously important considerations have not been discussed due to the uncertainty of type and time of development expressed in previous sections. However, it can be shown that population probably will not be in the magnitude of many hundred thousand that has been speculated. The best study to date was done by the Bureau of Mines for projecting development in 1990 and 2020 for Wyoming and Montana in the Powder River Basin.(75) We wish to consider only Montana county development given the demand assumptions of the report.

In the report, plant development with a medium coal usage estimate, is given for the year 2020 and is close to the 1990 high usage estimate. A summary of the plants is given in Table 16 with employment figures calculated according to stated assumptions. The total plant employment with high coal

Table 14.

Direct Coal Mining Tax Revenue in Rosebud County, 1969-71

	Western Energy		Peabody Coal		Tax on Burlington Northern Royalties		
Year	Property Taxes	Net Proceeds Tax	Property Taxes	Net Proceeds Tax	Western Energy	Peabody Coal	Total Taxes
1969	$30,504	$ 58,853	$ ---	$ 2,847	$ 3,938	$ 9,339	$105,481
1970	32,230	147,473	21,354	28,367	27,858	31,324	288,606
1972	37,709	418,770*	20,691	53,304*	79,855*	30,267*	640,626

* based on mill levy of .114217 mills

SOURCE: Rosebud County Treasurer's Office, Courthouse, Forsyth

Table 15.

Direct Coal Mining Tax Revenue As A Percent of County Taxes

Year	Total Coal Taxes	Total County Taxes	Coal Taxes as a % of County Taxes
1969	105,481	$1,632,460	6.4
1970	288,606	1,889,084	15.3
1971	640,626	2,109,439	33.0

SOURCE: Rosebud County Treasurer's Office, Courthouse, Forsyth--based on figures obtained from the office.

usage in 1990 would be 7,370. The coal mine employment of 4,210 is summarized in Table 17 and was calculated according to stated assumptions. The total employment figure would then be 11,580 in 1990 for Montana. The ratio of employment to population of .384 used in the Montana Economic Study may then be applied to yield a population figure with high coal usage in 1990 of 30,100. At $250 million per plant this would amount to a $6.5 billion investment windfall for Montana. This is not even considering investment generated by new employees.

The foregoing guesstimation work is naturally based upon many tenous assumptions. However, it is apparent that the development will be far greater in capital investment than population. This should mean that there will be adequate revenue to provide needed services.

The number of jobs generated by spin-off industries was not considered. Petrochemical and other energy dependent industries could locate near plant sources, but this will be based again on an economic decision of whether it is cheaper to export the energy to population centers or to import equipment to Montana and export goods to population centers. The export by transmission line and pipeline would appear to be the most likely at present for most industries. The concept of plant by-product uses would take much refinement and the market availability in Montana is open to some question.

Table 16.

Guesstimation of Montana Coal Conversion Plant Employment (1990 with high coal usage)

	Production	Employment		Total
		Plants 1/	Plant	Employment
Electrical Generation	1,000 MW	7 2/	80 3/	320
Synthetic Gas	500 Mill. S.C.F./day	8	470 4/	3,760
Synthetic Crude Oil	100,000 bbl/day	7	470 5/	3,290
	Total			7,370

1/ based on Bureau of Mine Study in Powder River Basin (21)
2/ present Montana Power development added to Bureau of Mines study estimate.
3/ based on known steam plant employment rate by Montana Power of 60/750,000 KW.
4/ based on Memorandum from Office of Coal Research (67)
5/ assumed equal to that of gasification.

Table 17.

Coal Mining Employment ot Satisfy Coal Requirements of Guesstimated Plants and Export

	Coal*	Plants	Total Coal*	Employment 1/
Electrical Generation	5	4	20	289 1/
Synthetic Gas	13	16	208	2,971
Synthetic Crude Oil	15	7	105	1,500
Export			30 2/	450 1/
			363	4,210

* million tons per year
1/ based on productivity of 200 tons/man day (Western Energy rule of thumb) and 350 working days/year.
2/ based on high estimate--Harold Levine estimates on 20 million tons

Jobs generated by the plants, coal mines, and their construction would be significant for certain segments of the labor market. Construction, mining, maintenance, and engineering opportunities would be directly created. This will not be a panacea for Montana out-migration, but it could reverse the population loss in affected counties.

The State would derive revenue from coal development as well. The coal mine license tax is based upon the tonnage and BTU value of the coal. In the twelve months ending in June, 1972, the State tax was estimated at $650,000. The State also receives monies from sale of coal leases and from the royalties on that coal when it is mined. Royalties have been 15 cents a ton for lignite, 17.5 cents a ton for subbituminous, but suggestions have been made for a new system based on BTU value. The State collects additional revenue from the corporation license tax based on 6½% of the net income and ad valorem taxes. A thorough study evaluating and comparing Montana coal taxes to those of surrounding states is needed.

The State Electric Energy Tax is 1.438% of gross income from sales of electrical energy generated and sold in the State, and there is a tax on natural gas distributed in the State of .575 of one cent per thousand cubic feet.(70) As possibilities of exporting power and gas increase, the State should examine the tax potential related to energy production that is consumed out-of-State.

The discussion of economic factors has thus far assumed that proper reclamation will restore the value of the land. Problems in other states have focused on destroying the land's economic value and county tax base. This should not be a problem in Montana since counties receive great tax contributions during mining, reclamation should restore the land after mining, and land values are quite low in comparison to other states. The average assessed value of all lands in the eight coal counties was only $5.05 per acre.(70) Irrigated land might run as high as $52.02 per acre, but this is a relatively small portion of land area. An Illinois and an Indiana study reflect a basic methodology for assessing local economic effects of strip mining and a similar projective study for Montana would be particularly instructive.(6, 65) A study method could include an economic base study of the selected region.(73)

The alternative must be examined of what counties may do if reclamation laws are not strengthened or take a long period of time. Actions could include assessing stripped lands the same as surface lands, minus the mining rights.(6) This would provide a more long lasting form of revenue that was not directly tied to operations. A gross proceeds tax based on an equitable rate would be the most consistent revenue in taxes during actual mining.

Hopefully, the weakness and incompleteness of many of the foregoing economic considerations is apparent. This is again because of the large number of factors that are variable. Most eastern Montanans are also concerned about what development could imply for the social fabric of the region. The question of what can be done in the face of uncertain time and place of development must now be examined.

A RATIONAL ORDER

> "It is today a fact that we have been over come by dynamic changes and that we do not even try to impose a rational order. When we do, it is on a small scale, for a short period, and very often after the process of committments has started...that is, when it is too late."
>
> Constantinos A. Doxiadis (61)

The economic benefits that can be derived from development are substantial, but the possible adverse affects on the environment and people are substantial as well. Several changes in reclamation laws have been suggested to help insure maintenance of productive land. However, it is apparent that much additional planning and legislative action to provide tools for planning are urgently needed. Montanans are now faced with a change that is dynamic, and feeble solutions after development has started will not suffice. Montana can provide national leadership in insuring well planned and beneficial development, or it can continue on its present course of being a colony of major U.S. corporations.

Governor Forrest Anderson announced August,1972, an inter-agency task force to study the coal development problem had been formed. Studies such as this and the study you are reading are helpful in determining problems and providing necessary data, but it must be recognized that they do not do any thing. Studies may provide information, but do not have either the mechanism or the initiative in State, county, or city government to do anything beneficial with the information.

The problem is compounded because studies cannot provide much guidance because the timing and nature of development is dependent upon so many variables. Energy companies themselves are probably quite in doubt as to exactly what may occure in research and regional demands in five or ten years. Studies are also meaningless because they cannot wire-tap the corporate board rooms where the ultimate decisions are made. The end result of studies is usually data with variances from 500 to 1,000%!

Efforts in the planning area should then be directed at the following: (1) providing systems inventory information of natural and social resources, (2) establish future priorities for the land and its use, (3) establish local mechanisma to plan alternatives for potential growth, and (4) establish State authority to evaluate corporate plans for major construction. All of these public inputs need be considered before development is announced. Once development is desired, these efforts would insure that public interests would be considered and that proper lead-time and mechanisms for planning were present.

The four goals outlined are based upon the philosophy that the public wants and needs to be involved in decision making that affects their lives. Former Secretary of the Interior, Walter Hickel noted that in today's society there are very few purely private decisions. Decisions must really be considered public because action cannot be taken without significant effect upon others.(30) This forms the basis for a challenge of cooperation between business, government, and the people to establish goals and reconcil conflicting viewpoints.

Means of meeting the four outlined planning goals may now be examined. Providing an inventory of an area's natural and social resources is a goal that needs coordination. These have been inventoried and studied to the point where another federal or State agency could be established to study studies. In fact this is what should occur, one central office should integrate all known data relative to land-use, water, economic, and social factors. State and federal agencies are duplicating efforts in land and water planning. We have simply reached the point where we have gathered so much information that the primary aim appears to be the gathering of data rather than the beneficial use of it. Federal land-use planning legislation might provide Montana with such an opportunity.

The reason for one clearinghouse is to provide an integration of this data into a systems description of the State. Elements essential to a systems description of an area are summarized in an excellent article by George Darrow, Chairman of Montana's Environmental Quality Council.(13) The interrelationships between the land, people, economy, and environment are complex, but must be considered if any value is to be derived from various data. If data is to be communicated and used, we must also have one central office fulfilling this function.

This relates to the second and third goals of establishing future priorities for land and establishing local mechanisms to plan alternatives. Local people must be intimately involved in deciding future land use priorities. The State and federal personnel can provide valuable inventory and systems information that the local people could not be expected to generate on their own. The agency personnel must actively seek to communicate the information that they have available. The local people must establish planning bodies that may make effective use of this information. The legislature must act to provide for State land-use planning to give authority to decisions that are reached and to provide sufficient staff.

The concept of land-use planning is considered to be a dangerous infringement on private rights by many. However, it merely provides a means to inventory our resources, and to guide, not dictate, its development.

The law of eminent domain gives mining companies a tool that could barely be matched by society's tool of land-use planning. National land-use planning legislation has been introduced and a State plan might supersede future federal impetus.(10)

In coal affected counties, little or no effort is taking place to form county-wide planning bodies. Only by having county-wide planning can the people of the region effectively inventory their resources and problems. Only through such bodies can the people of a county work for their own protection in the face of development. Current county officers are already overburdened with day-to-day chores. A county planning body can help to insure that the people will have a knowledgable and strong voice in State and federal decisions.

As previously noted, the federal government owns coal on over 50% of Montana coal lands. The Bureau of Land Management and Forest Service is currently conducting a land-use study of 900,000 acres in southeastern Montana. The Decker-Birney planning unit has 49,000 acres already covered by State and federal coal leases, and additional lease applications service as impetus for the study. Over 88% of the coal rights in the area and federally owned.(54) The study provides an excellent beginning for a method of considering social and economic values before development occurs. Such federal efforts should be encouraged and integrated with local groups. The public should be aware of such planning endeavors to provide input and to insure that political pressures do not lead to hasty or improper evaluation and decisions.

The fourth consideration in planning is for a State authority to evaluate major plans for construction. Such a State energy siting authority should not be limited to consideration of power plant siting. It should include a review procedure of gasification plants, liquification plants, power plants, aqueducts, and all energy transmission routes and facilities.

A State energy siting authority could insure that the public interest was represented in siting decisions. It would force corporate decisions into the public, so planning mechanisms could prepare for development. To achieve these ends, requirements for disclosure of future corporate plans and public hearings should be included. Environmental standards should also be included to provide a one step agency procedure for project approval that could help expedite decisions.(8)

Arizona, California, Maine, Maryland, New York, Oregon, and Washington have all taken steps to help resolve power plant siting and transmission line location questions.(8) The State Public Service Commission is the obvious and least appealing Montana agency for the law's administration. The Public Service Commission should be given the staff to do the job, and the people can and should elect commissioners that will responsibly fulfill their duties.

The problem is that private companies make their decisions based upon their evaluations of economics and operational needs. Their interpretation of public will has become increasingly involved, but the public can only act after the decision has been made. As a utility executive of Northern States Power Company noted, people want to have a part in how their mineral resources, environment, and rate money will be used.(8)

The total problem might be summarized by noting that we have much that can be done to prepare for development. Hopefully, Montanans will responsibly act in time. This is another study.

SUMMARY OF RECOMMENDATIONS

Development can be beneficial, but only if many of the considerations of the report recommendations are realized. A summary of report recommendations directed at the national perspective are as follows:

1. National energy conservation policies of an energy use tax, new building insulation standards, and discouragement of private auto use should be adopted.
2. A national energy policy reconciling resources with demands should be formed.
3. A coordinated National Grid System should be implemented by Congress to enhance utility coordination.
4. Magneto Hydro Dynamics (MHD) research should be greatly expanded, with infusion of funds.
5. Alternative energy producing alternatives should be more fully explored.
6. Federal funds and programs for development of land-use policies should be passed by Congress.
7. Public utility advertising should be banned except in cases where it would serve to increase efficiency.
8. Strict federal strip mining legislation based upon the concept of orginial use should be enacted.
9. A coordinated study of coal affected areas should be initiated.
10. The Montana-Wyoming Aqueducts feasibility study should be supported and enacted by Congress.

A summary of report recommendations directed at the State perspective are as follows:

1. Steam power plants should not be built in the State of Montana considering their potential harmful effects and the alternative energy techniques that could maximize resource use with little environmental damage.
2. Revision of reclamation laws should provide for authority for the administering department to deny strip mining of certain areas, to regulate mining methods, to require topsoil cover. The law should provide for reconditioning to previous or better use, for a stable cover of native vegetation, for an appeal of the commission's decisions by affected landowners, and raise the maximum bonding limit.

3. An administrative system with judicial review of water rights allocations should be enacted.

4. State land-use planning legislation should be enacted.

5. A clearinghouse for data and establishment of a systems description should be established.

6. A state energy siting authority should review all plans well in advance for power plants, gasification plants, liquification plants, aqueducts, transmission lines, and other facilities.

7. County planning bodies should be created and work actively to inventory and evaluate resources.

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THE RESOURCES DEVELOPMENT INTERNSHIP PROGRAM

The preceding report was completed by a WICHE intern during the summer of 1972. This intern's project was part of the Resources Development Internship Program administered by the Western Interstate Commission for Higher Education (WICHE).

The purpose of the internship program is to bring organizations involved in community and economic development, environmental problems and the humanities together with institutions of higher education and their students in the West for the benefit of all.

For these organizations, the intern program provides the problem-solving talents of student manpower while making the resources of universities and colleges more available. For institutions of higher education, the program provides relevant field education for their students while building their capacity for problem-solving.

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The ideas and opinions expressed
in this report
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March 8, 1973

Mr. Jim DeBree
Economic Development Association
of Eastern Montana
P.O. Box 388
Sidney, Montana 59270

Dear Jim:

We certainly appreciated the opportunity of meeting with you a couple of weeks ago concerning the coal study, as prepared by Mr. Jovick. You asked that I jot down a few comments in writing and we will attempt to comply with your request.

First of all, we would like to suggest that anytime a study or report of this nature is undertaken, that somewhere along the line, the author should contact those industries involved with the subject. Please understand, the suggestion is not made in order that private industry may write or even influence the report. We merely ask for the opportunity to express our views, predictions and forecasts. The author is free to use or discard, to agree or disagree with industry as he sees fit. Perhaps a company could suggest additional sources of information, show the author various records and experiences or whatever. Again, our concern is not to direct or control the study but merely the opportunity to participate and to be heard.

More specifically, I take issue with the author's statement on page 18, "The philosophy of the utilities is to provide as much energy as possible and reap the subsequent dividend." No business in America should be embarrassed to make every attempt to earn a reasonable profit. The utility industry is a regulated business and as such, our financial records are open to the public. Those records clearly show that a return on invested capital of 4-5-6-7 or 8% are certainly not exorbitant. In addition, our philosophy is to serve the energy needs of people and hopefully at a reasonable profit so that good service can be provided in the years to come.

On page 19 and 20, the report is very critical of utility firms' expenditures for advertising. Later in the report, the author states these monies should be spent on research. First of all, our advertising expenditures are very nominal. The figures vary between companies, but I suspect it is approximately $.10 per customer billing. Secondly, our advertising is not designed to encourage unlimited growth of energy consumption. We are seeking very selective growth in order to have a more balanced energy load and thus a more efficient production and distribution system. Thirdly, advertising is the only effective means that our firm or any business has available to communicate with our customers. How else can we explain our business and service? Certainly this is a basic right that should not be denied in our free enterprise system.

The author states that MHD technology is the answer to all our energy problems and that no more steam generation facilities should be constructed in the state. I agree MHD offers many possibilities and advantages, but the facts are clear that we are sometime away from this type of generation satisfying the demand for energy. To place a moratorium on steam plants in the meantime is absurd. The author gives no consideration to the fact that our demand for energy grows each year and those demands cannot be met if we just wait for an improved technology to come on the scene. We should also mention the state of the art concerning all forms of energy generation is improved and advanced each year. Steam generation alone had made tremendous strides in the last decade. The plants are more efficient, are no longer harmful to the environment and they do make use of an existing resource - coal.

The report also recommends the creation of a so-called national grid system. We do not believe such a system is necessary to provide dependable electric service. MDU, for example, is part of a large regional power planning and pooling organization. MAPP is insuring efficient and reliable service in a multi state region. To place a national grid system on top of all this would be extremely costly and would not improve either reliability or efficiency of electric service.

With the above exceptions, we do support other statements in the report, including continued research and development programs in the field of energy supply and generation, fair and equitable regulation of all participants in the energy business, strong and reasonable reclamation laws, land-use planning and plant and transmission siting legislation. A sound national energy policy and others.

Please accept my comments as sincere and constructive criticism. We are not a all critical of the author, your association or the overall project.

We continue to offer our support and cooperation in your association's program and hope that you will feel free to call on us.

Again it was a pleasure to meet with you.

Sincerely yours,

Robert O. Heskin
Area Development
Representative